FEB 26 1920

VOL. LXXXVI. No. 2202. [All Rights Reserved.] FEBRUARY 6, 1920. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of Postage.] PRICE SIXPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. 4. SUBSCRIPTION RATES, Postage Free: United Kingdom and Canada, £1 12s. 6d. per annum.; Colonial and Foreign, £2 1s. 6d. per annum.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie Etrangère, 22, Rue de la Banque.
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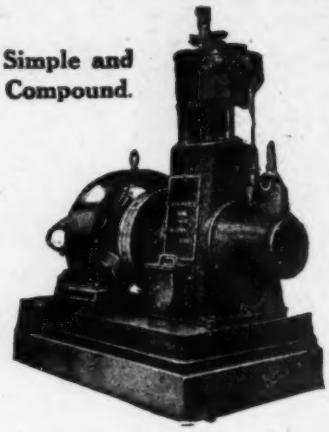

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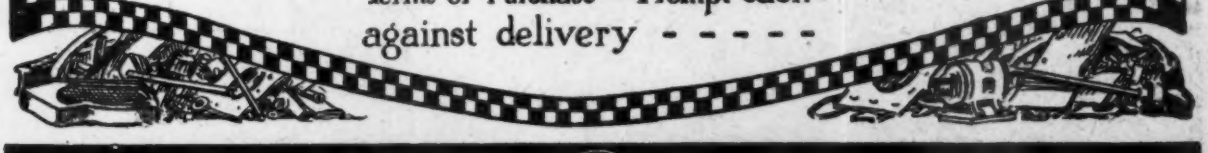

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ELECTRICAL REVIEW.

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THE PRICE OF THE "ELECTRICAL REVIEW."

During the War, almost exceptionally among technical publications and periodicals of the character of the ELECTRICAL REVIEW, we have refrained from increasing the price. Owing, however, to the constant increases in cost of paper, printing, engraving and production charges generally, we have reluctantly decided that the price from the beginning of this year must be raised to 6d. per copy. The change will not apply to unexpired subscriptions.

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THE NEED FOR THE SPIRIT OF CONFIDENCE.

THE promotion of good feeling and mutual confidence and esteem between employers and employed, is a question which has been one of the most prominent in the minds of those—and they include almost everyone—who have been brought into contact with it, for some considerable time. From many of the daily papers it might be gathered that it has only arisen during the war, and there are those who curse the ex-Kaiser—wretched being—for the moulders' strike, the railway situation, the coal shortage, and all the disadvantages of the present industrial situation.

Those whose knowledge and industrial experience go back beyond August, 1914, will probably agree that the war did little more than precipitate various aspects of this among other problems, and that the problems themselves—or this problem of industrial relations at any rate—are of such venerable antiquity as almost to seem eternal. Like the poor, they are always with us, and there are, and always have been, extremists on either side. The famous Statute of Labourers, enacted after the Black Death, sought to force all able-bodied persons, of either sex, to serve any employer who required them to do so, and to take only the wages which prevailed in the district before the plague began. Later, the labourer was tied to the district, and if he or she left it, was liable to be hunted, brought back, and subjected to various pains and penalties: in Scotland miners were bought and sold with the mines in which they had to work. The Peasant Revolt under Wat Tyler arose largely out of this attempt at coercion, and the Complaint of the Commons of Kent, under Jack Cade, 70 years later, was to a great extent due to circumstances to which many parallels can be found at the present time. Any attempt at an historical survey of the subject, though of considerable interest, would take up a great deal of space, and would lead us beyond those limits within which we prefer to remain. Let it suffice to say that there are still employers and others who, although not employers, think with them, who would seem to wish that all workers should be compelled to work whenever required, for fixed wages, and should be content to be turned off and left to exist as best they can when not needed for the production of goods. On the other side there are those who would make an equal division of the wealth of the world, and who would give the most corrupt and incompetent an equal voice in the Government with the real hard worker.

In both classes of extremist the underlying idea is a desire to be the top dog, and a feeling that all merit resides on one side only of the case. There is a lack of any spirit of confidence: and it is this spirit which alone can influence the situation for good. It is useless and wicked to talk about "the inevitable conflict between Capital and Labour," and "the need for a little blood-letting," or for a class war. The advocates of these policies always fail to ask themselves the question: What will be the situation *after* the inevitable conflict, or the class war, has been fought and won and lost, or the blood has been let? The answer is that the problems, which just now we ventured to call eternal, will still be there, and will still need tackling, while feeling will have been exacerbated and settlement rendered more than ever difficult.

The industrial question, then, although much discussed, seems as chaotic as ever. This seeming chaos, however, is only due to the many-sidedness of the question and to the necessity of continual adjustment. There never can be any finality where growth is concerned. The tree which

ceases to grow, dies. The business which fails to make progress, falls sooner or later into liquidation, and comes to an end. There is no comparison possible even between one generation and another, for in the whole community generations overlap, and so the adjustment required is, as we have said, continual.

The aspects from which the question may be regarded are many. There is that of the relationship between federations of employers and Trade Unions, or federations of them. This aspect has been developed more in Great Britain than in any other country in the world, and it is of very great importance, inasmuch as it prevents local settlements as well as local strikes, though it is more effective in the first case than in the second. The fastest pace of a squadron of ships is the fastest pace of the slowest ship in the squadron. Where federations are concerned, the fastest pace at which the federation can move is the fastest pace at which the most obstinate constituent member of the federation can be persuaded to move. Then there is that of the relationship between individual employers and trade unions, which has been developed in the United States and the constituent nations of the British Empire, as well as in Great Britain and elsewhere. Again, there are those of the relationship between individual employers and individual workers, between employers and other employers, between workers and other workers; and last, but not least, there is the question of the relationship of the public at large to any or all of the other parties.

Thus outlined, the question of industrial relations is seen to be one of the most vast with which statesmen and thinkers can occupy their minds. When we consider one small corner of it, viz.: the relationship between an individual firm and its employés, we cannot fail to be struck by the negligent way in which it is dealt with. Lip-service is rendered to the need for the spirit of confidence, and a great deal is said about team-work. In some cases attempts are made to bring the various classes of workers together at clubs, where concerts, games, dinners, dances, lectures, and the like can be arranged. It is seldom, however, that employers, or even the higher officials, participate actively in such things; and a lengthy experience has convinced us that measures of this sort scarcely touch the fringe of the question. They contribute little or nothing to effectiveness during work. Conditions of remuneration, heating and cooling and ventilation of the works or offices, and attention to the personal comfort of the workers as regards the cleanliness of the place in which they have to work, decent sanitary accommodation, the provision of lockers in the works, and of comfortable desks and chairs in the offices—all these are more productive of improved efficiency than billiard tables or cardrooms, football matches or dinners.

Yet, in a large concern, it is frequently found that every departmental manager engages his own staff, and fixes their remuneration according to his own notions. There is a great deal of secrecy between various sections as to the salaries paid—why, we have never been able to discover. In the public service, whether Imperial or municipal, salaries are known from the various year books, and although public employment has some unpleasant features, it at least ensures that positions of equivalent responsibility in various sections or departments receive equivalent remuneration. In manufacturing concerns expediency is the governing factor, and the tendency is to pay as little as the worker will take.

An article by Mr. Dudley R. Kennedy, in *Industrial Management* for November, 1919, entitled "Employment Management and Industrial Relations," brings out the need for accomplishing the improvement of those relations in the proper spirit. The good intentions of a board of directors can easily be frustrated by the incompetency or lack of goodwill of those whose duty it is to carry the board's policy into effect; and, be it noted, the failure of an attempt of this sort is a most disastrous thing, for distrust of the genuineness of the intentions behind it is inevitably engendered.

The Labour policy must, says Mr. Kennedy, be directed by some one individual, of high executive rank. His duties are numerous and important, and his standing must be equal to that of the heads of the financial, manufacturing, designing, or selling departments. Such an individual would be able to study the conditions obtaining, and to evolve a system of grading various positions, assigning remuneration between certain limits in accordance with merit and length of service. This accomplished, a great step would have been taken towards the inculcation of a spirit of confidence and trust between employé and employer.

Mr. Kennedy observes: "While it may seem to be a broad statement, nevertheless it is becoming more and more a conviction with many, that where an employer's employés secede *en masse* to the ranks of a Union, that they have gone to those whom they feel can help them, and that the employer has lost their confidence in his integrity, his honesty, and his fairness." While the grammar is deplorable, the truth of the statement is manifest, and many, if not most, of our readers will realise its personal application. While on the subject of grammar, we should like to express the hope that in future articles Mr. Kennedy will do his best to avoid such sentences as this: "The fact that even that many people are somewhat familiar with the subject is attributable largely, I think, to the fact that because of requirements imposed by the necessities of war production, coupled with the sudden atrophy of immigration, a very drastic shortage of labour has occurred." These lapses overlooked, Mr. Kennedy seems to have the root of the matter in him. We believe that there is a tendency in Great Britain in the direction indicated. Some few individual firms have real employment managers who prepare and administer the policy throughout all the ranks of the employed persons, from the directors to the cleaners and errand boys. Others have a labour department which deals with the operatives, and has no concern with the staff. Many more have employment departments which deal with applications and file statistics, but have no more interest in the policy of the firm than the employment exchange. Of these, the first is the right policy, and it would soon prove itself to pay best from all points of view, because it would bring about and maintain the spirit of confidence, which to-day is conspicuous by its absence.

Employes' Inventions.

At a meeting of the City Council of Christchurch, N.Z., according to the *Auckland Weekly News*, it was reported that the city electrical engineer, Mr. E. E. Stark, had patented an instantaneous hot-water heater and an electric kettle capable of boiling water in seven minutes, and had offered to the Council the right of manufacturing and selling these articles; as they were manufactured and sold by the Council's electricity department with considerable success, the Electricity Committee had agreed to pay the royalties on them to Mr. Stark. Opposition was raised to this, on the ground that when an employer paid a man for his services he had a right to the product of that man's brains while they affected the occupation in which he was employed; but the chairman of the Committee considered that if a man invented anything, that invention was his own property, and on a division the report was adopted by 12 votes to 2.

That was a right decision—not only morally just, but right in the eyes of the law. Unless an employé is engaged for the specific purpose of inventing and of developing inventions on behalf of the employer, he retains an unquestionable right to the products of his brain; he is entitled to patent his inventions in his own name, and to demand the payment of royalties by his employer, should the latter desire to manufacture or use such inventions.

Employers whose ethics are in need of correction are apt to claim the inventions of their workers as theirs by right; they are, however, entitled only to the labour that they pay for, not to the fruits of a worker's inspiration. Hence clever ideas on the part of workmen ought to be handsomely rewarded if they effect a saving in the cost of manufacture, or if they lead to the production of new devices. To give a man 5s. for an improvement in a workshop process which will save the firm hundreds of pounds, is

sweating in its most aggravated form—nay, worse, it is robbery, and could only be justified in a state of slavery under which the worker was body and soul the property of his master.

As stated by Frost in "Patent Law and Practice," "in the absence of special contract, the invention of a servant, even though made in the employer's time, and with the use of the employer's materials, and at the expense of the employer, does not become the property of the employer so as to justify him in opposing the grant of a patent for the invention to the servant, who is the proper patentee, and the patent when obtained is the exclusive property of the servant." The servant may, however, under certain circumstances, be declared by a Court of Law to hold the patent as trustee for his employer. A patent taken out by an employer alone for an invention discovered and worked out by an employé is void.

Automatic Sub-stations.

The rapid progress which is being made in the adoption of automatic sub-stations in the United States is indicated in the interesting abstract which we reproduce elsewhere in this issue. The principle is, of course, an old one; those who are familiar with the early days of electricity supply will call to mind several examples in this country, such as the direct-current system installed at Oxford, Chelsea, &c., in which the rotary transformers were placed in unattended sub-stations, and, with the batteries, were controlled from the generating station. It must be admitted, however, that these were only semi-automatic, and that, so far as we know, none of them has survived to the present day. The American installations, on the other hand, are often entirely automatic, going on load when the demand calls for it, and switching themselves out when the load falls off; although the first of them was started up as recently as Christmas, 1914, there are now no fewer than 37 installations in operation and 35 on order, and rotary converters as large as 1,000 KW. are handled automatically, while a 2,000-KW. motor-generator is about to be put into service, and a 3,000-KW. synchronous condenser is running. It is clear that the system has proved successful, and that great economies have resulted from its adoption, not only in wages, but also in capital outlay on feeders, and in the saving of light-load losses.

On various occasions we have drawn attention to these sub-stations, and in our issue of June 21st, 1918, we gave an illustrated description of a hydro-electric generating station which was automatically controlled on similar lines; the latter is of considerable importance in view of the possibility of utilising the numerous small waterfalls in the mountainous districts of this country. By using asynchronous generators the difficulties of speed regulation and synchronising can be overcome, and the control reduced to its simplest terms. In these days it is very necessary to stop the leakage of energy derived from natural sources, and turn it to practical use, as Mr. Steinmetz pointed out in an article which we recently quoted. We may again draw attention in this connection to the competition for the best solution of the problem of conserving the Welsh water-powers, which will take place at the National Eisteddfod in August; particulars were given in our issue of November 14th, 1919, and entries must be completed by May 24th.

Manufacturers and the Act.

Directly the broad purpose of the Electricity Supply Act is achieved, so soon will a corresponding benefit accrue to the manufacturers of electrical apparatus used by consumers. This purpose is, first, an ample supply of electric power for industries; secondly, cheap electricity for domestic purposes. Cheapness in either direction means an extended use of the supply by consumers, and, as this can only be done by using apparatus, it means a big opening, in the first case, for electric motors, and, in the second, for electric cooking and heating apparatus (chiefly). But outside the prospect of the Act thus increasing the market for direct sales to consumers, there is for manufacturers a more special point of interest—namely, the encouragement which the Act gives to electric supply undertakings (both company and municipal) to hire out apparatus. Now, the wholesale use by people of, say, electric cooking and heating apparatus, must depend, in a great measure, upon whether the various undertakings will consent to hire. In the case of electric motors this hiring question has a similar bearing, although not to anything like the same extent. But in the case of cooking stoves and heating apparatus the hiring question seems paramount, certainly if we are to judge by the analogous case of gas companies, whose hiring of gas stoves has been the foundation on which their huge cooking and heating business has been almost entirely built up. Now the present Act gives a much-needed legal recognition to the practice of hiring. Up to the present, through no fault of the undertakers, however, the hiring of electric apparatus has been of a languishing and intermittent character. Municipal undertakings especially have been handicapped. But by Section 23 of the Electricity Supply Act the question of hiring is placed on an unequivocal footing. It provides that "a joint electricity authority and any local authority authorised by special Act or by order to supply electricity may provide, let for hire, and in respect thereof may connect, repair, maintain and remove . . . electric lines, fittings, apparatus and appliances for lighting, heating and motive power." . . . Further, the section contains the important proviso that any of the apparatus and appliances thus provided on consumers' premises "shall be deemed to form part of the undertaking." . . . The whole business of hiring apparatus is made legally part and parcel of the operations of both municipal and company electric supply undertakings, and there is no obstacle, therefore, to business going ahead in this direction immediately circumstances allow of it.

Further, as a subsidiary favourable factor acting in the same direction, the erection of capital stations will gradually relieve individual undertakings of the necessity for further capital outlay on generating plant, and so set them free to use all available capital to develop the distributing side of the business, in which hiring schemes should play a useful part. As to the manufacturers' part in this, there is every urgency for them to effect standardisation of apparatus as far as possible, since in hiring schemes *standardised* apparatus is almost a *sine qua non*.

A New Federation.

To-morrow, at the instance of the Labour Research Department, a meeting of representatives of associations of administrative, clerical, and professional workers is to be held in London, with a view to the formation of a "National Federation of Professional, Technical, and Supervisory Workers." According to a circular issued by the Labour Party, the purpose of the new organisation will be "to work out common economic programmes" for its constituents.

We are assured that "the question of political action is, of course, completely outside the scope of this conference," a statement which may be taken for what it is worth; that one object of the movement is to promote friendly relations between the "black-coated" class, as the Press has it, and the industrial workers' organisations is not disguised, and the political views of the chairman of the conference, Mr. G. D. H. Cole, of the Labour Research Department, are well known to be of an advanced nature. Associations which are subsidised by employers are expressly declared to be ineligible for affiliation.

The draft constitution of the proposed federation is harmless enough on the surface, and we should be the last to demur to the promotion of friendly relations between staff associations and labour unions, and between them both and the employers; we heartily desire to see them all working together for the common good on the most harmonious terms. But everything depends on the motives which do not appear on the surface, and which have to be gauged and tested by other means than external appearances. We await further particulars with interest, and in the meantime suspend our judgment on this latest turn of the association kaleidoscope.

CLEANING BLAST-FURNACE GASES.

For several years past the advantages of the use of cleaned blast-furnace gas have been freely discussed, and it has been proved that a very marked increase in efficiency can be obtained by the use of gas which has been highly purified.

The advantages to be secured by properly cleaning the gas are many, and may be summed up as follows:—(1) The operation of stoves and boilers becomes more uniform; (2) interrupted operations due to the clogging of gas connections are avoided; (3) the cost of cleaning pipe connections, stoves and boilers is reduced to a minimum; (4) the loss of heat due to repeated cleaning of stoves is avoided; (5) the useful effect of the hot-blast stove is increased because the heating surfaces remain clean; (6) the operation of gas

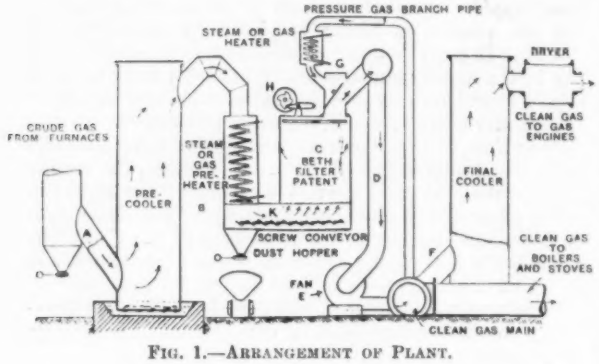


Fig. 1.—Arrangement of Plant.

engines becomes regular and positive; the clogging of passages and the rapid wear on the moving parts of the engines is avoided. The advantages gained by the use of clean gas in gas engines are already too well known to need any further comment, but the excellent results obtained by

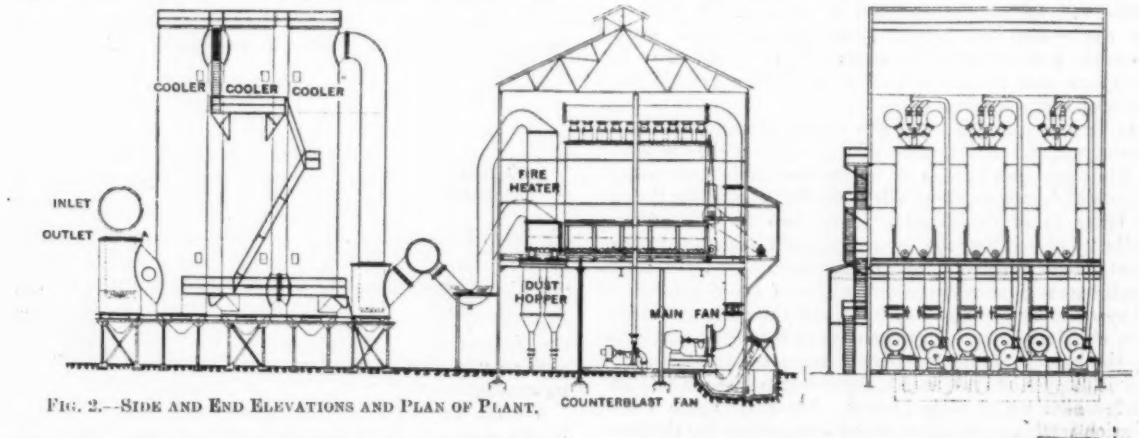


Fig. 2.—Side and End Elevations and Plan of Plant.

the use of clean gas in stoves, boilers, steel furnaces, &c., have not up to the present been fully appreciated.

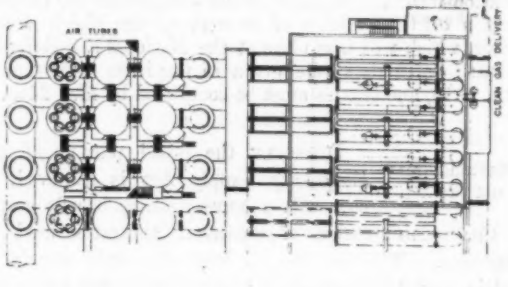
Although in the past the installation of large gas engines has not made such rapid strides in this country as on the Continent and in America, there is evidence, under the new conditions, where economy is of such vital importance, that their installation is being seriously considered by iron and steel-works engineers. Various authoritative tests have been published during recent years, both on gas engines and boilers, worked under these new conditions, but up to the present no information is available as to the benefits to be derived from the use of highly-cleaned gas in soaking pits, mixers, melting furnaces, push furnaces, coke ovens, foundries, briquetting plant, &c. By thoroughly cleaning the gas and preventing all waste, there appears to be no reason why the whole works should not be run without the use of solid coal, or even producer gas.

Apart from the dry separation of the heavy particles in dust-catchers, which are usually placed close up to the furnaces, blast-furnace gases have, until quite recently, been cleaned by the wet system—that is, by bringing the gas into close contact with water. Within recent years, endeavours have been made to eliminate the inherent objections to the wet method of gas cleaning, some of which are:—(1) The difficulty of recleaning the water, rendering large settling tanks a necessity. (2) The difficulty of dealing with the wet mud. (3) The inconvenience and expense of keeping the tanks clean and in good order. (4) The large consumption of water, which is often not over-plentiful, and expensive to obtain near blast furnaces. (5) The large consumption of power.

The Halberg-Beth dry-cleaning plant cleans the blast-furnace gas by separating the dust without requiring water. The sole manufacturers of this plant in Great Britain are Messrs. Fraser & Chalmers, of Erith, Kent. In March, 1910, a small plant on this system, having a capacity of 175,000 cb. ft. of gas per hour, was installed. The experience gained with this plant led to two others being started in June and July, 1911, having respective capacities of 700,000 and 900,000 cb. ft. of gas per hour. The excellent results obtained were followed by a great demand for this type of cleaner, and in 1914 50 installations of plant of large capacity were in various stages of construction, the total capacity amounting to 140,000,000 cb. ft. of gas per hour.

The following is a brief description of the Halberg-Beth dry gas-cleaning system:—The gas given off by the blast furnaces at greatly varying temperatures, dependent upon the working and condition of the furnaces, is collected and conveyed by a main pipe A (fig. 1) into a suitable cooler of the surface type. The temperature of the gas is thereby reduced to 150-170 deg. F. After cooling, the gas passes into a superheater B, and is superheated from 15 to 25 deg. F. to safeguard against the risk of moisture being deposited on the filter bags, and then passes on into the Beth filter chamber C.

The standard Halberg-Beth filter is a mild steel rectangular



box divided up by one longitudinal plate running the full length of the box, and by shorter partition plates across the box, such that there are two double rows of 10 compartments in each filter box. In each compartment there are 12 open-ended bags, the lower ends being attached to rings which are rigidly fixed into a plate just above the dust-collecting chamber running the full length of the filter box. The tops of the bags are closed by means of steel caps with

suitable attachments for hanging on to the shaking frame. To the centre of each of the latter is fixed a suspension bolt projecting through the top plate of the filter box, and made gas-tight by a suitable gland; these are connected to the shaking gear H, which is bolted to the top plate. Great care is taken in the manufacture of the shaking gear; every part is made to a jig, and is interchangeable.

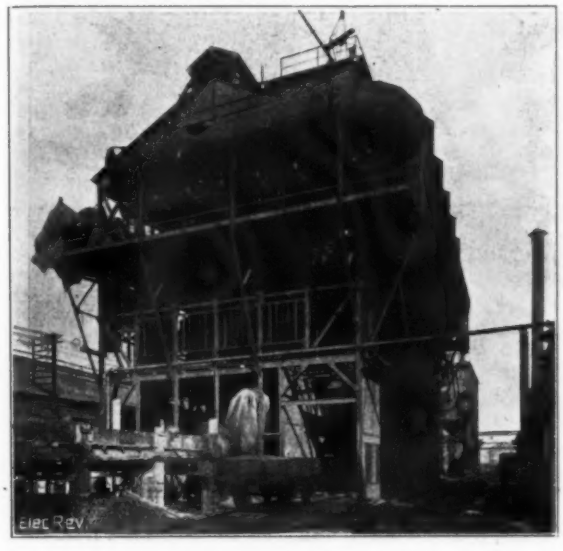


Fig 3.—Gas-Cleaning Plant in Course of Erection; Capacity, 5,000,000 cb. ft.

The gas passing from the inside to the outside of the bags is drawn through the filter plant by means of one or more fans, E, which only deal with clean gas. Whilst the gas is being drawn through the filter bags, the dust settles on the inside, and a simple device automatically and thoroughly removes the dust. At regular intervals during the whole time the plant remains in operation, each chamber of 12 filter bags is, in proper sequence, cut out by means of the valve G, which is automatically operated; this valve cuts off the fan which is drawing gas through the plant from the particular compartment and allows clean gas, at a higher pressure than that of the crude gas, to flow in the reverse direction into the filter chamber, and in passing from the outside to the inside of the bags, this blows the fine particles out of the mesh, and loosens the heavier particles clinging to the insides of the bags.

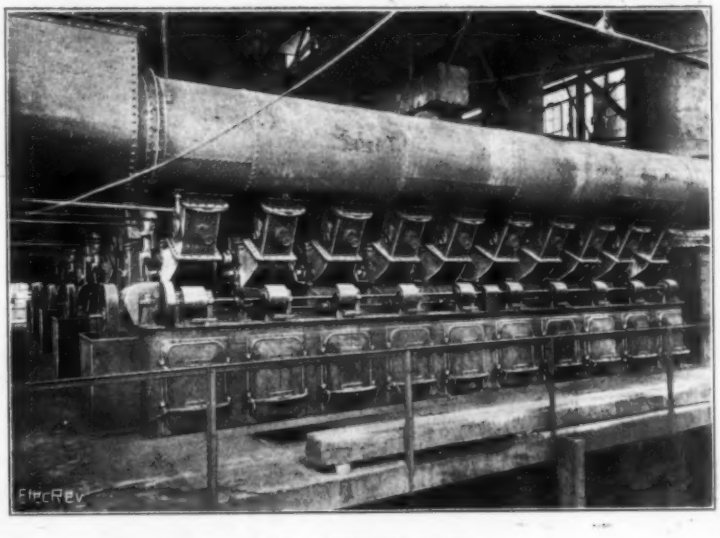


Fig. 4.—Filter Boxes.

During the time that the counter-current of clean gas is flowing, the shaking gear comes into operation, and the frame, together with the 12 bags suspended therefrom, is raised and dropped about seven times, with the result that the dust collected on and in the filter bags is shaken down into the chamber at the bottom of the filter box, which is provided with a spiral conveyor to deposit the dust in hoppers, these being emptied periodically direct into trucks.

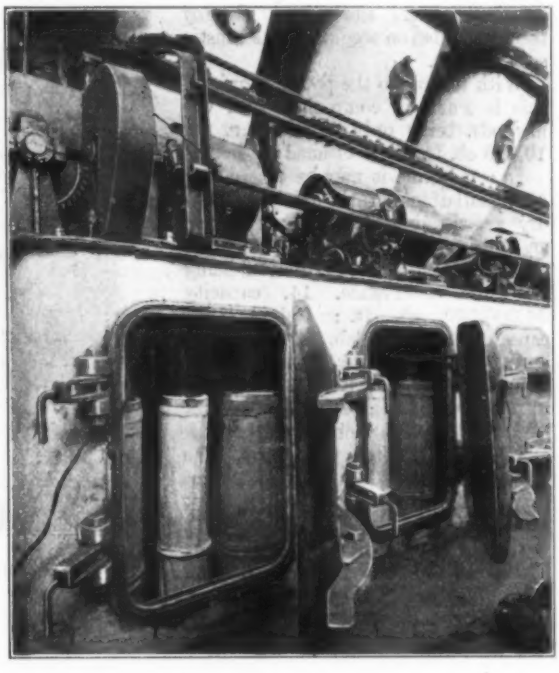


Fig. 5.—Shaking Mechanism, Top Inspection Doors, and Filter Bags.

Immediately each section of bags has been cleaned, the top suction valve is automatically switched back into the forward position again. The whole operation lasts 15 to 20 seconds, and the process is repeated at intervals of about seven minutes. With an original dust content of about 6 grammes per m^3., the gas, after passing through the cleaning plant, will only contain about 0·01 to 0·02 gramme per m^3. This cleanliness is obtained in ordinary service; experience has shown, however, that as low a dust content as 0·001 gramme per m^3. is often continuously obtainable.

With regard to the superheating of the gas, the simplest medium is steam, requiring from 6 to 7 lb. of steam per 10,000 cb. ft. of gas per hour. With a well-arranged insulated superheater, B, and filter chamber, C, this consumption can be reduced. As an alternative, instead of using steam, the exhaust gases from gas engines, stoves, &c., can be used.

If the cleaned gas is intended for driving gas engines, the fact that its temperature on leaving the cleaning plant is at least 140 deg. F. necessitates cooling before use. This is carried out by a simple arrangement of coolers fitted with water sprays; the device is very efficient and economical, the water remains quite clean, and can, after spraying, be used for any other purpose without purifying. After the gas passes the final cooler it is arranged to pass through a water separator, and thence it goes on to the gas engines.

The life of the filter bags is from 6 to 12 months, and the cost of replacing these is small. Actual experience has proved that the bags frequently last 18 months and even two years; the reason for their long life is the fact that the temperature of the gas is automatically kept at a little above the dew point. This prevents both the burning and clogging of the filter tubes by hot gas or wet dust; the latter alone would destroy the filter tubes on account of its caustic soda content.

With regard to the power required, this is small in comparison with wet methods, being only about 1 H.P. per 10,000 cb. ft. of gas cleaned per hour.

In conclusion, it may be stated that 59 installations of the Halberg-Beth dry gas-cleaning plant in Europe have an aggregate capacity of 174,000,000 cb. ft. per hour, the distribution being as follows:—France, 14, capacity 36,000,000 cb. ft.; Belgium, 4, capacity 8,700,000 cb. ft.; Germany and Luxemburg, 23, capacity 75,000,000 cb. ft.; Russia, 4, capacity 8,350,000 cb. ft.; Great Britain, 14, capacity 45,050,000 cb. ft. per hour.

We are indebted to Messrs. The General Electric Co., Ltd., for photographs and the particulars set out above.

On the occasion of our recent visit, at the invitation of the General Electric Co., to Messrs. Fraser & Chalmers's works at Erith, plant of the type described above was seen in course of manufacture as noted in our issue of November 14th, 1919. Fig. 9 is a view at Messrs. Palmers Shipbuilding and Iron Co.'s works, which we described in our last two issues, where gas is cleaned by the above process before being used in the gas engines.

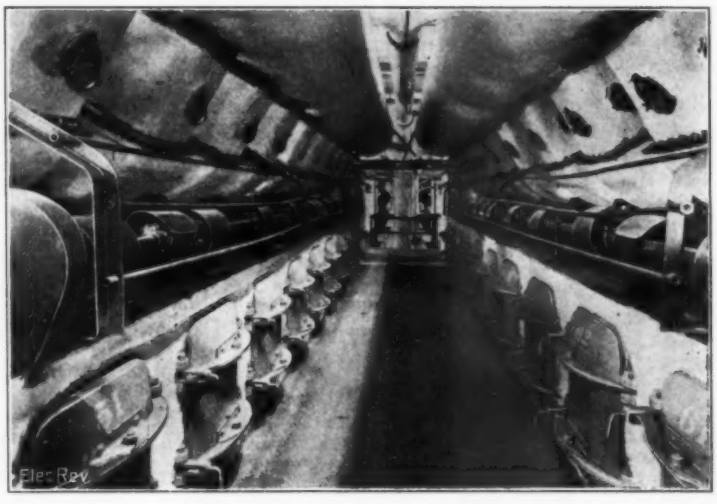


FIG. 6.—FILTER BOXES, SHAKING MECHANISM, AND TOP SUCTION PIPES.

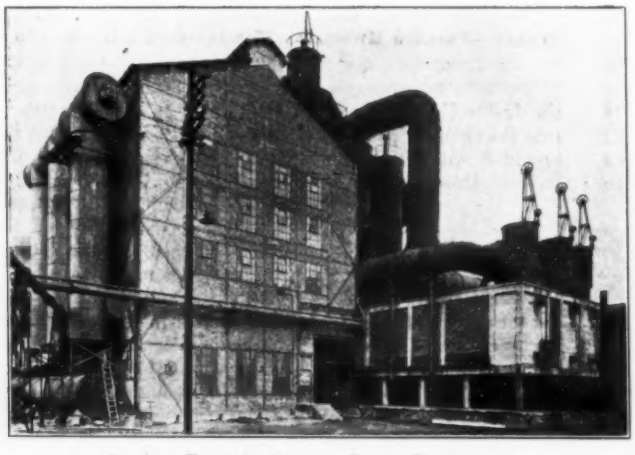


FIG. 7.—ECONOMISERS AND STEEL COOLERS IN BACKGROUND.

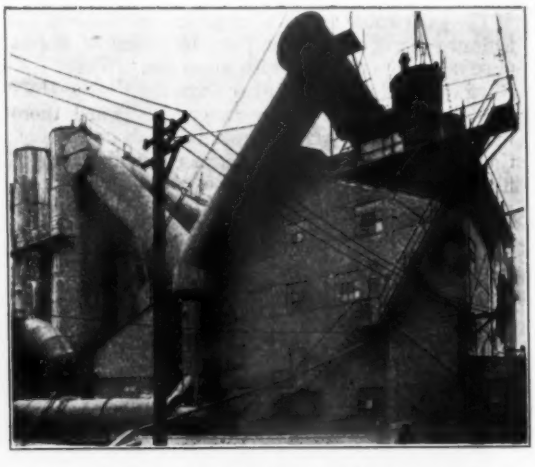


FIG. 9.—STEEL COOLERS, COOL GAS INLET, AND MAIN WATER-SEAL VALVES OVER FILTER HOUSE.

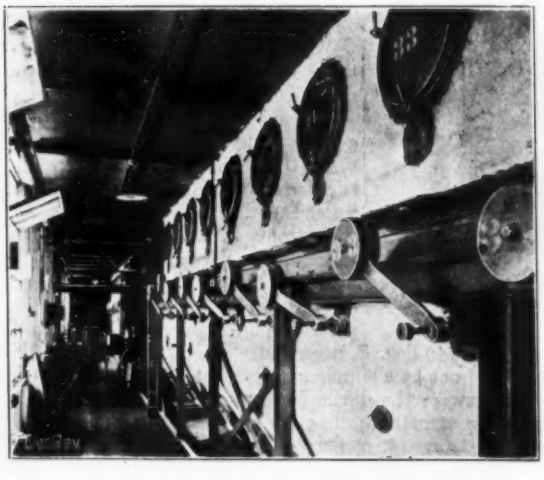


FIG. 8.—BOTTOM FILTER BOX ISOLATING AND INSPECTION DOORS.

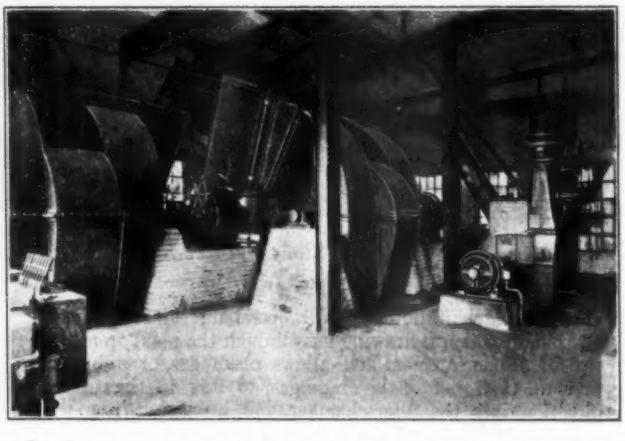


FIG. 10.—FANS AND MOTORS

THE COAL REBATE—A COMMENT.

By E. W. DOREY.

In your issue of January 16th you published details of the rebate to be granted to consumers of electricity for domestic or household purposes as a result of the reduction of 10s. per ton on the price of coal supplied to electricity supply stations and used for the generation of the electricity so supplied.

The basis of the reduction is sound, from the standpoint of the supply undertaking, in that it gives back to the consumer the *net* saving to the supply undertaking resulting from this 10s. per ton reduction, but it is to be feared that the consequent disclosure to the domestic consumer of the lb. of coal used per unit sold will give rise to trouble, for reasons which will now be gone into.

The formula quoted in your issue of the 16th inst. is as follows :—Rebate to consumer per unit metered (tons of coal used in quarter/units sold in quarter) × 114d.

Taking a concrete example, we have :—

(5,000 tons/3,000,000 units) × 114d. = 0·190d.

This assumes 600 units sold per ton of coal used, or 3·74 lb. of coal per unit sold, a figure which is obtainable in the larger stations, and on this basis the rebate would amount to 0·190d. per unit ; with smaller stations burning 6 lb. per unit sold, the figure would be 0·305d. per unit.

Many supply undertakings are distinctly averse to divulging the lb. of coal used per unit sold, but, apparently, they will now have to "own up." For instance, if a quarterly account for 100 domestic units shows a rebate of 20d., by simple mathematics, we get—

Rebate per unit 20d./100 = 0·2d.

lb. of coal per unit = 0·2d. × 2,240 (lb. per ton)/114d. (rebate) = 3·93.

A consumer of 100 units, therefore, costing him perhaps 6d. per unit, viz., 600d., would get a rebate of 20d., the equivalent of a reduction of 3·33 per cent., indeed a cause for congratulation ! How the accounts clerk is to be envied, now that he has one further complication to add to his burdensome duty.

It will be impossible to prevent the thinking consumer from comparing the "war" increase with the now "post-war" rebate. A good deal of propaganda was distributed by supply undertakings to make the consumer *au fait* with the reasons for the increase in rates, viz., rise in cost of fuel, wages, stores, &c., but now we have the first general decrease, and when it is considered that 10s. per ton is, on the average, one-third of the total cost per ton of coal to-day, delivered to the supply undertakings, and that this fact will be evident to the consumer, the reduction of a paltry, say, 3·5 per cent. only on the bill will need some explaining, even by those "skilled in the art."

Now that it is a question of reducing the rates, the absolute minimum is offered, and logically the consumer expects to find that when the supply undertaking imposed an increase, the absolute minimum was enforced—for how could a pious supply undertaking management be expected to stoop to profiteering ?

An analysis of what has taken place will suffice to show whether the consumer is justified in his expectations, and for a basis to work upon reference will be made to the table, "Pre-War and Post-War Prices Charged for Electrical Energy," published by the Electrical Review.

The following extracts relate to three typical supply undertakings of considerable size :—

Undertaking.	Rates for lighting.		Coal per ton.		
	1914.	1919.	1914. s. d.	1919. s. d.	Increase on 1914.
A	3·5d.	+ 50 %	12 1½	26 2½	117 %
B	4d.—2·5d.	+ 100 %	14 1	28 4	101 %
C	3·5d.	+ 100 %	10 6	21 6	103 %

It is not unreasonable to take 70 per cent. of total costs as fuel costs, leaving 30 per cent. to cover "other costs," viz., stores, wages, &c. (these figures, of course, do not cover capital and other standing charges).

Using as a basis for the analysis a figure of 5·0 lb. of coal per unit sold (a liberal figure), the equivalent of 450 units per ton, we find, if we take example "C," the following. Coal cost per unit sold :—

Year 1919.—258d. (21/6)/450 = 0·575d. Year 1914.—126d. (10/6)/450 = 0·280d. ; difference 0·295d.

The increased cost due to increase of fuel from 10/6 to 21/6, is, therefore, 0·3d. per unit sold. It will be seen that this undertaking "C" increased the rate from 3·5d. to 7·0d., *i.e.*, an increase of 3·5d. per unit.

If it be assumed that the "other costs" per unit are 30 per cent. of the total, and we take the 1919 figures, we find that the total generation cost per unit sold is 0·575/0·7 = 0·8225.

The "other costs," therefore, = 0·8225 — 0·575 (coal) = 0·2475d. per unit sold.

If it be allowed that these "other costs" are up 120 per cent. over pre-war figures, we find that they have risen by 0·135d. only, so we have a comparison between 1914 and 1919 as follows :—

Increase due to fuel	0·295d.
" " "other costs"	0·135d.
Total increase	0·430d.
"C" undertaking has charged an increase of	3·5d. per unit.
"C" undertaking's generation costs increased by	0·430d. "
Difference	3·070d. "

The figures of generation costs per unit sold do not cover standing charges, and the high cost per unit for domestic supply, when compared with a supply for power, is due to the heavy capital outlay necessary to afford the domestic supply. It is necessary, however, to remember that during the war the number of such consumers connected was strictly limited by the Government, and it is, perhaps, not unreasonable to suppose that about 70 per cent. of the present domestic consumers were connected in 1914, that is to say, the capital to afford these supplies was expended prior to the war. An increase of 100 per cent., to be justified, pre-supposes that the costs have gone up 100 per cent. ; but how can such an increase be justified in the case of the 70 per cent. majority who were connected prior to the war, and for whom the capital was already expended in 1914 ?

Now that the basic facts and figures are to be given to the public, it is as well to face these facts seriously, and see exactly what the position in reality is. Perhaps one had better not even try to imagine what the average consumer will say when he sees the whole question in the light of day, but imagine yourself a pre-war consumer taking a supply from an undertaking as "C" above :—

1919 you paid	7·0d. flat per unit.
1914 you paid	3·5d. " "
Increase	3·5d. " "
Supply generation costs have increased by	0·430d. " "
Difference	3·070d. per unit.

During the period 1914-1919 coal has risen 11s. per ton, and the increase enforced is 3·5d., and now coal has fallen 10s. per ton you get the magnanimous reduction of 114/450 = 0·254d.

What one is to say to the hypothetical consumer referred to above, is a question that perhaps some supply engineer can answer. In the interests of the electrical industry, it is very desirable that the reasons for these very heavy "war" increases of 50 per cent., 75 per cent., 100 per cent., &c., on pre-war rates should be known, as to-day it is not quite a "walk over" when competing with gas for domestic use.

It should be clearly understood that when quoting case "C" above taken from the Electrical Review table, the figures have been utilised only to construct a hypothetical case which is somewhere in the region of practical every-day life.

THE NEED FOR A CHEAP HOUSE-SERVICE METER.

By C. W. MARSHALL.

The present extraordinary demand for household supplies of electricity makes it opportune to bring to general notice a subject which has occupied the attention of supply authorities for many years; this is the problem of reducing the capital charges on the installations to values in keeping with the revenue derived from them. There is much to be said in favour of charging systems which do not involve the use of meters at all for small consumers, but the leading engineers appear to be almost unanimous in desiring to get accurate records regarding all clients. In order to fulfil this requirement an integrating meter of some sort must be installed, and this is probably the most expensive item of the equipment.

On alternating-current systems the metering problem is comparatively simple, as the induction watt-hour meter is so excellent in its performance over a wide load range, and so simple in construction, that it seems to be merely a matter of scientific production to bring the cost of an instrument to a very low level.

With direct current it is an entirely different matter; D.C. watt-hour meters are far from satisfactory from the standpoint of accuracy under all conditions or over a long period, and the potential circuit losses are by no means negligible in most types of meter. An ampere-hour meter therefore appears to be the only practicable solution. The different types may be classified roughly under electrolytic meters, commutator-motor meters, and mercury-motor meters. At the first glance the electrolytic meter appears to give an immediate solution to the problem, but experience does not seem to justify this view, as such meters are not used to any great extent, while the British Engineering Standards Association does not recognise the type at all (Report 17, 1919, p. 7.)

Commutator-motor meters, although used to an enormous extent on the Continent and in America, have not made much progress in Britain, and at least one important firm has ceased to manufacture all its models of this type. Climatic conditions in northern Britain make the difficulty of producing a satisfactory commutator type meter almost insuperable.

The field is accordingly left almost clear for the mercury-motor meter. This class of meter has been developed to a stage of accuracy and reliability almost comparable with the A.C. watt-hour meter. The cost of such meters is, however, very high, and the present designs are not such as to allow much hope for great reductions even with the best mass production methods. It is unfortunate, too, that one of the most promising mercury meters was withdrawn at the outbreak of the war before it had attained a firm hold on the market. The present writer is of the opinion that the most hopeful way of developing the mercury meter would lie in designing an instrument of the utmost simplicity, shorn of all compensating devices, and in view of the great progress made in magnet production, this should now be within the bounds of possibility.

It is hoped that this article may help to stimulate those interested in the electricity supply industry to endeavour to solve the cheap meter problem, which may be stated as follows: "It is required to design a reliable electricity meter of the ampere-hour or watt-hour type for a maximum current of 5 amperes, which shall satisfy the Board of Trade requirements for accuracy, and which can be produced at a cost not exceeding £2." Those within the meter industry will probably follow more or less on conventional lines, but it is possible that laymen may be more successful in attacking the problem with fresher minds. The writer has already had some very novel suggestions from the latter source which may be published at a later date, but up till now the only practical result of these projected meter schemes has been to deepen his respect for what has been done by the pioneers.

The present-day costs of electricity meters are approximately as below:—

A.C. watt-hour meter, 5 amperes, 110 v. £3 10s. each.
D.C. commutator ampere-hour meter, 5 amperes, £2 10s. each.
D.C. mercury-motor ampere-hour meter, 5 amperes, £4 10s. each.

OUR LEAD SUPPLIES.

We invite the earnest consideration of all consumers of lead to the present position as disclosed by the Board of Trade returns for 1919.

The pre-war importation into the United Kingdom amounted to over 200,000 tons per annum, of which about three-fourths came from Australia and Spain. The average quantity from America was about 30,000 tons, all of which was obtained from Mexican lead desilverised in the U.S.A., and exported thence under the drawback system.

For the three years ending June last, the Government has been responsible for the total supply, nearly all of which was used for war purposes, domestic consumption being practically shut down.

The Government bought the whole of the Australian production, as well as huge quantities in Spain and America, and of necessity had to provide for war consumption many months ahead. The result was that when the Armistice was signed and war consumption ceased, the stock here in Government hands of about 60,000 tons, rapidly increased until by May, 1919, no less than nearly 130,000 tons was in store. In addition to this, the producers in Australia held a much larger quantity for Government account.

There was, therefore, at that time every prospect of a continued surplus of lead for a long time ahead, far beyond any possible requirements.

How is it, therefore, that there is now a prospect of such a serious shortage that trade may possibly be seriously crippled?

As we have said, the Government stock at the end of 1918 was about 60,000 tons. The imports last year amounted to 217,610 tons, against which 36,373 tons were exported, leaving 181,237 tons balance of imports over exports for home consumption, plus the Government stock. The outlook is serious, because our chief suppliers, the Australian mines, have been completely shut down since early in May last year, owing to the strike there, and there is no indication of the mines being re-opened. Thus for nine months a productive capacity of enormous proportions, and from which we received no less than 93,276 tons last year, has been for the time being eliminated. It is said that if the strike were to end to-morrow it would take four months before smelting could be fully resumed. Of the stock held in Australia in May last, very large shipments have been made to Japan and China, and what with this and the shipments to the United Kingdom, the balance is not more than sufficient to complete existing contracts, or, at any rate, there cannot be much free lead to count upon. Another serious point in the Australian position is that the miners have gone from Broken Hill in increasing numbers, and have been absorbed in other callings.

From Spain last year we received only 39,502 tons, a quantity far short of our normal supplies, and the principal producing company in Spain has recently given out that its total production for this year has been absorbed in the Continent of Europe.

In these circumstances, special attention is due to the imports for last year. Of the total of 217,610 tons, 152,258 were received in the first six months, and only 65,352 tons in the last half of the year. Of this latter total we received in November and December combined only 15,175 tons, and the exports of British and foreign combined were 12,267 tons for the two months. The Government stock is now under 30,000 tons unsold.

Consumption for domestic purposes must largely increase, and every country in Europe is short of lead. Germany, Holland, and France have imported considerable quantities from us in the past few months, notwithstanding the

adverse rate of exchange, and America supplied us with only 1,868 tons in the three months ending December 31st last year.

Lead Statistics for 1919.

Imports—	Oct. Tons.	Nov. Tons.	Dec. Tons.	Total for the ye . Tons.
Australian ...	8,852	2,104	5,635	93,276
Spain	7,058	200	3,352	39,502
United States ...	594	280	994	53,008
Others	1,614	95	2,615	31,824
	18,118	2,679	12,496	217,610
Exports—				
Foreign lead ...	3,181	2,576	2,449	10,803
	14,937	103	10,047	206,807
British	4,222	3,298	3,944	25,570
Net imports ...	10,715	—	6,103	181,237
Decrease in stocks				7,877
U.K. absorption ...				189,114

LEGAL.

British Thomson-Houston Co., Ltd. *v.* Corona Lamp Works, Ltd.

(*Continued from p.* 139.)

On Wednesday, Jan. 28th, Mr. Kerly, K.C., for defendants, said a statement had been got out by the plaintiffs' accountant showing the sales of lamps by three companies in what he called "the ring," viz., General Electric Co., Siemens, and British Thomson-Houston. He had no doubt that the figures were perfectly correct, but he would like to know what was the number of ordinary tungsten vacuum lamps sold in the same period, viz., the last five years. The defendants' estimate was that it would be about 60 millions.

Mr. Colefax, K.C., for plaintiffs, said the figure for gas-filled lamps was actually 5,905,932 for the last five years, viz., 1914-1919. There had been a very rapid increase in the sales. In 1914 they were 41,000, in 1915 280,000, 1916 452,000, 1917 1,109,000, 1918 1,727,000, and 1919 2,296,037. During the war there was great difficulty in getting the goods, because the manufacture of electric lamps was controlled. He happened to know, because he was the controller. One difficulty was the glass bulbs, and another difficulty was argon, which was made in Holland. With regard to the sale of tungsten vacuum lamps by the three companies, for 1919 the figure was 9,589,208. The total sales of all lamps for that year were 11,885,245.

Mr. Kerly, proceeding with his opening speech, said that with regard to the prior documents, he was not looking for a statement in words that one had to take a thick wire in one's gas-filled lamp, nor for a statement that one had to take a coil of wire, but he would say that he would find in plain language in those documents that if one had a gas-filled lamp one could run the filament to give a greater brilliance, and that because the lamp was gas-filled that could be done without undue danger to the life of the filament, and that it was the presence of the gas in the lamp which told one that one could run to a higher temperature with a corresponding higher brilliancy than was possible in a vacuum lamp. It was in order to get the possibility of that higher temperature without danger to the life of the lamp that one employed the gas, and it was for that purpose that it was employed in the prior specifications.

Mr. Ballantyne, an analytical chemist, and an expert on electric lamps, gave evidence. Dealing with the prior specifications, he said the idea of a gas-filled lamp and of a metal filament for a gas-filled lamp was not unknown at the date of the plaintiffs' patent.

On January 29th, in re-examination, Mr. Ballantyne said he knew of an article which originally appeared in the *General Electric Review*, entitled "Nitrogen-filled lamps."

Mr. Percy Rayner Smith, assistant to Mr. Atkinson Adam, gave details of comparative tests of a Mazda ½-watt lamp and a Corona lamp.

Mr. Atkinson Adam, giving evidence, said the tests were designed to show what efficiency the plaintiffs' lamp was giving.

At the conclusion of the evidence counsel addressed the Court, and the hearing was adjourned.

On Tuesday, February 3rd, Mr. Colefax summed up the plaintiffs' case, and at the close of his speech his Lordship said he would give judgment in a day or two.

Electric Drive for Mills in Foochow.—According to a U.S. Commerce Report, the Foochow Electric Co. has recently adopted the scheme of renting electrically-driven rice-milling machinery to small mills, thus securing a rental for the machines and a profit from the electrical energy consumed by the mills in running the machines.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Coal (Pit's Mouth) Prices Order and Direction, 1919.

A point has been raised with regard to the question of "coal delivered during the month of December, 1919," as referred to in the Coal Controller's "prescription," and in reply to my query to the Coal Mines Department, I have been informed as follows:—

"Coal for electricity undertakings which was dispatched from the colliery prior to December 1st is not subject to the reduction of 10s. per ton under any circumstances.

"The term 'delivered' in the prescription was used in explaining the method by which the amount of deduction was to be computed, but the Coal (Pit's Mouth) Prices Order and Direction, 1919, makes it quite clear that only coal dispatched from the colliery on or after December 1st is subject to the reduction."

I shall be glad if you will kindly give publicity to this explanation.

T. W. Cole,
Secretary.
Provincial Electric Supply Committee of the United Kingdom.

London, E.C.
February 3rd, 1920.

Coil v. Magneto Ignition.

We were particularly interested in the article in your issue of December 12th on the above subject, in which Mr. A. C. Booth recorded the satisfaction derived by him from an American car purchased in 1915, and fitted with a Delco electric lighting and electric starting equipment. Our notice was especially drawn to his statement that the three cells have stood up to the four years' work, and have not so far required any attention other than a little distilled water once a month. This testimonial is the more gratifying insomuch that the battery in question is of the "Exide" type, manufactured in this instance in Philadelphia, but identical in every respect with the "Exide" cell manufactured at our works, Clifton Junction. This type of battery has been adopted as a standard by several of the leading British motor manufacturers.

The Chloride Electrical Storage Co., Ltd.

Clifton Junction.
January 29th, 1920.

The "Lesco" Lampholder.

With reference to Mr. A. Peden Rutherford's letter in your issue of the 23rd inst., we do not wish to take up your valuable space, nor do we think that any useful purpose would be served by either of us ventilating our personal grievances.

We quite admit that at one time we were in negotiation with Mr. Rutherford, but we should like to contradict his statement that such negotiations were broken off by us, as this was not the case.

Lesco, Ltd.
T. M. Kirkby, *Director.*

Manchester.
January 30th, 1920.

The correspondence relating to lampholders has, I think, proved both useful and interesting. In spite of the very good test obtained by Mr. Hope on a new holder, I still think that the two minute indentations on his holder are insufficient for the purpose. Where holders are turned out in large quantities it is well known that variations take place. Furthermore, it is by no means an uncommon thing for a wireman to take the top off one holder and put it on to another. In these circumstances one may be quite sure that some holders will be put up with a slack fit, and the force required to pull them apart will be much less than that mentioned by Mr. Hope. At seaside places, particularly, corrosion of the brass is by no means unknown, and I believe that this phenomenon sometimes occurs in other than seaside places. A very small amount of corrosion would very nearly abolish the indentations, in which case one might look out for trouble.

Some day I trust Mr. Wordingham's proposed proving house will be established by the industry, when holders of new and old patterns will be tested by independent experts and certified or rejected as the case may be. The certificate of the proving house would be a great benefit to the inventor, as it would give him a good start off, while the absence of a certificate would prevent things from coming on to the market which might be unsatisfactory in their performance. Seeing that everybody will gain by the proving house, one cannot but wonder why there is so much delay in establishing it.

C. Turnbull.

Electricity Works, North Shields.
February 2nd, 1920.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Orling Jet Relay.

In a booklet issued by the Orling"s Telegraph Instruments Syndicate, Ltd., of 47, Victoria Street, S.W.1, an account of the Orling jet relay is given. The apparatus depends upon the principle that a fine jet of water may be deflected by the point of a needle, and that the angular movement of the jet is much greater than that of the needle.

An ordinary cable recorder coil of the usual 500 ohms resistance is stiffly suspended in a magnetic field of moderate strength. Attached to the top of this coil is an aluminium arm 30 mm. long, a waxed edge of which is brought into contact with a jet of slightly acidulated or salted water issuing from a tube. This jet is quite steady, and its angular movements are entirely controlled by the receiving coil.

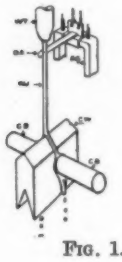


Fig. 1.

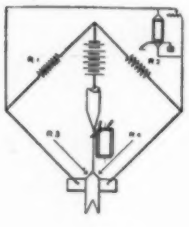


Fig. 2.

20 mm. below the arm a wedge-shaped piece of celluloid is clamped between two carbon electrodes, and is so placed that the jet falls upon the apex and is divided into two parts.

When in operation, the jet never leaves the apex of the wedge, across which it is always astride, signal impulses to one side or the other merely varying the position of the jet on the dividing edge of the wedge and causing more or less water to flow down one or other of the inclined sides of the wedge.

Fig. 2 shows the arrangement of the local circuit when the instrument is used as a magnifier, particularly for signals through long submarine cables.

It will be observed that R_3 and R_4, down which the divided parts of the jet flow, constitute one pair of arms of a Wheatstone bridge, the other pair being formed of the fixed resist-

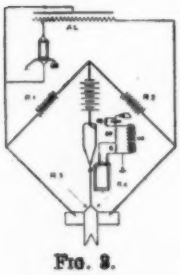


Fig. 3.

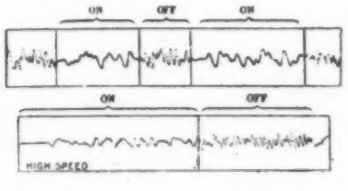


Fig. 4.

ances R_1 and R_2, whilst a siphon-recorder, or other instrument suitable for a local circuit, and the local battery are connected to complete the bridge arrangement.

The recording instrument is actuated with precision and force by means of the local current, which flows when the balance is upset by the minute to and fro motion of the jet astride the wedge.

The balance of the local circuit is doubly differential in that the cross-sectional area on one side increases by as much as that on the other decreases. Thus the resistance is much less on the one side and much greater on the other.

By arranging the circuits as shown in fig. 3 a very useful discriminating effect is produced, whereby telegraphic signals are picked out and all disturbing currents of a rapidly varying nature are rejected.

Records of an experiment in which artificial electrical disturbances were applied to the circuit are shown in fig. 4. The sections marked " off " mark intervals of time when the instrument was out of the circuit and only the disturbances were then recorded. A photograph of the apparatus is reproduced in fig. 5, in which also may be seen the rotary pump driven by a small electric motor for furnishing a continuous supply of water to the jet.

It is claimed by the makers of this instrument that it has printed Morse signals on a Wheatstone inker with a current of 0.02 microampere at the rate of 450 letters per minute, the current strength in the receiving coil being as low as 4×10^{-11} ampere. They also state that, at experimental trials made at an Atlantic cable station shortly before the out-

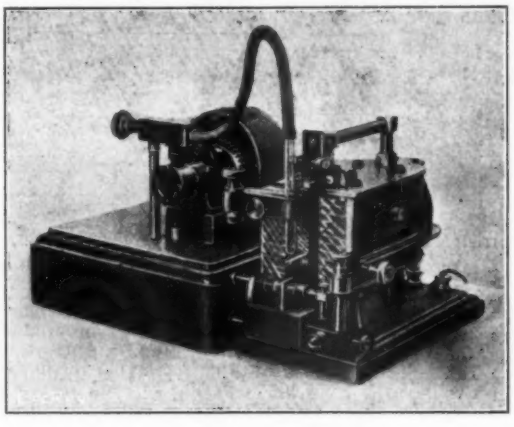


Fig. 5.—Orling Jet Relay.

break of war, as a simplex instrument with duplex connections the jet relay raised the previous safe-signalling maxima by 125 per cent. with perfectly defined signals.

On another cable of higher E.R. a speed constant of 1,500 was attained. The publication also gives an outline of several modifications of the same apparatus.

The " Albert " Current Limiter.

Messrs. Ward & Goldstone, Ltd., of Sampson Works, Salford, Manchester, are putting on the market a simple little device for preventing the consumption of current in excess of that intended for the circuit on which it is installed, as for instance in hotel suites, flats supplied through a common meter, and small dwellings not provided with separate meters. The controller, which is illustrated in fig. 6, consists of a trigger and a small electromagnet in series with the circuit; when the current exceeds the prescribed value, due to the switching-on of an extra lamp or other consuming device, the trigger releases a hammer which knocks off a switch and opens the circuit. To restore the supply, an external switch handle is turned to set the trigger, and at the same time opens the circuit at another point, so that it is

Fig. 6.—The " Albert " Excess Current Controlling Device.

impossible to obtain an excess supply by holding or tying the handle; on releasing the handle the circuit is completed, and if the offending lamp has been cut off, remains complete. Obviously the device functions also as a safety cut-out, taking the place of a fuse. It is enclosed in a cover which can be sealed. Provision is made for regulation over a wide range at the time of fixing the instrument, and five ranges are standardised, with maximum currents from 0.2 to 5 amperes. A single 30-watt lamp beyond the prescribed number on a circuit of any usual voltage actuates the device, which we have seen in operation.

BUSINESS NOTES.

Electrical Trade of German-Austria.—The German Foreign Office has been drawing attention to conditions in the electrical trade of German-Austria. Austrian manufacturers have been following the example set in other countries during the war, and endeavouring to increase their production by means of standardisation and specialisation in certain works. No great progress has been made, but undoubtedly a great deal of capital has been invested during the past four or five years in electrical manufacturing in Austria. Moreover, many additional schemes of this nature are in contemplation. It is considered, however, that apart from the technical qualifications of those interested, which are undoubted, the success of such enterprises depends upon their relationship to the German electrical industry. The Germans are apparently dubious of the attitude of their former allies. Consequently, the German electro-technical industry is advised to be prepared for something in the way of a present sacrifice with a view to recouping itself in the future. It is recommended to give special attention to the German-Austrian market, and particularly to the opportunities existent there for the development of water power. It is pointed out that the completion of such an undertaking will inevitably place the electrical industry of Austria in a strong position, and permanently increase the demand for machinery and apparatus.

A Westinghouse Re-union Dinner.—Mr. W. W. Hughes presided over a gathering of 160 ex-British Westinghouse engineers at their annual reunion at the Holborn Restaurant, London, on Jan. 23rd. This is the second occasion upon which ex-B.W. men have foregathered since the formation of an association which has for its object the promotion and continuation of friendly relations between men who originally met under the British Westinghouse banner at Trafford Park. The proceedings commenced with a reunion in the reception room. At the dinner which immediately followed, the chairman read a letter from Mr. Newcomb-Carlton, now president of the Western Union Cable & Telegraph Co., expressing his deep regret at being unable to preside. The guests should also have included Baron Ashfield (Sir Albert Stanley), Mr. Bonar Law, and Mr. J. Annan Bryce, but business engagements prevented them attending; the chairman also said that the committee had received over one hundred letters from ex-B.W. men all over the country apologising for absence. After the loyal toasts had been honoured, Mr. P. A. Sanders, O.B.E., gave that of the ex-B.W. Association. He asked all ex-B.W. men to join because it was not a business association, but a medium through which old and new friends could be met. Mr. L. R. Morshead responded on behalf of the committee. The chairman then gave the toast of the guests, to which the only guest present, Lieut.-Col. Montague Craddock, C.B., C.M.G., an old and popular British Westinghouse director, replied, and in doing so made a pleasing reference to his friendship with the late Mr. George Westinghouse. During the speeches fitting testimony was given to Mr. L. S. Richardson, the hon. secretary, for his work in promoting the Association and organising the gathering again this year. The members were especially pleased with Mr. Richardson's treatment of the programme and toast list—a humorous production containing many telling skits on various members of the Association. The concert programme was contributed entirely by members of the Association. Mr. A. Simon accompanied, Mr. Pochobradsky played the violin, Mr. H. S. Aspinal and Mr. F. Ollerenshaw contributed songs, and the humorous items were furnished by Mr. Val Wood and Mr. E. H. Miller. Mr. Richardson again introduced the bombass, which was uproariously received. Membership of the Association is open to men who were employed on the staff of the British Westinghouse Co. for two years, and who completed two years' service prior to September 30th, 1919; the annual subscription is 2s. 6d., and the hon. secretary, Mr. L. S. Richardson, 14, Sydney Road, Richmond, Surrey, will be pleased to furnish full particulars to all ex-B.W. men who would like to join.

"Welcome Home" Party at Leigh.—On January 22nd the directors and management of Callenders Cable & Construction Co., Ltd., Leigh, gave a fitting welcome home to all the men now in their employ who served in H.M. Forces during the war. The invitations also included their wives and children (up to 14 years of age), members of the various committees representing the employés, and those who have administered to the welfare of the men and their dependents while the breadwinners were away. The company present numbered more than 300.

The decoration of the canteen, which was the work of Miss Casstles (the lady welfare supervisor) and the electrical staff, was greatly admired, the Christmas tree adding greatly to the charming effect. The event commenced at 6 p.m. with a "high tea." Prior to the entertainment which followed, Mr. Bowyer, J.P. (works manager), said that it was the fourth occasion on which the firm had entertained the service men and their dependents, and this time they had the great pleasure of welcoming "the boys" home. He gave them a very hearty welcome. Sir Tom Callender had come specially from London to welcome the boys home on behalf of the firm. Sir Tom Callender expressed the great pleasure it gave him to be present. In assuring the boys of a hearty welcome, he said that out of 856 Callenders' employés who had served in the war, no fewer than 260 joined the various branches of H.M. Forces from the Leigh Anchor Works, and they had served in almost every part of the world in which the war raged. Some had received distinguished honours, and others, alas, no fewer than 27 Anchor men, had paid the supreme sacrifice. His brother, Mr. James Callender, who had also passed away, always took the greatest interest in all that pertained to the welfare and happiness of the employés at Anchor Works. He (Sir Tom) was pleased to say that every pre-war employé of the Anchor Works who had been spared had been reinstated, and the remainder of the pre-war employés who had yet to return would be similarly provided for. The firm were grateful to those who had enabled them to carry on during the war, and to do so much to keep up the production of war-time essentials. He had brought with him a small contingent from London to join him in the welcome he extended to all concerned. Gunner W. Hampson, who had both feet blown off by a shell, had a great reception on rising to propose a vote of thanks to Sir Tom Callender, to Mr. Bowyer, and to the management. Second-Lieut. John Hodgson seconded the vote of thanks, not only for the welcome home, but for the many kindnesses extended to service men all through the war. Sir Tom Callender had said how glad the firm were to have the men back, and he would add that the men were quite as glad to be back again with the firm. Sir Tom Callender having briefly replied, Mr. C. Pipkin, with whom were associated Mr. Howard Foulds and Mr. Hunter, all of Callenders' London Office, led three cheers for the "Boys who had returned," on behalf of the London contingent. In the entertainment which followed, Mr. Arthur Guilford (Manchester) distinguished himself as a versatile comedian. Mr. Alfred Horrocks followed with a clever manipulation of his "fantastical fan," and greatly amused young and old with his "Punch and Judy" show. For the children the event of the evening was the arrival of "Father Christmas" (looking the part to perfection) in his motor car loaded with sacks of presents which he proceeded to distribute with unstinted liberality. A plentiful supply of toy instruments was reserved for the adults, the playing of which culminated in the formation of a huge Jazz band. From 9 to 11 p.m., to the strains of Ramsdales Band, dancing reigned supreme, Messrs. J. Graham, J. Hoyle, and J. C. Pass being the efficient M.C.'s.

During the interval fruit and sweets were served to the children, and each lady received the firm's gift of a ¼ lb. of tea, and the gentlemen tobacco and cigarettes. The singing of "Auld Lang Syne" appropriately terminated the proceedings.

Lead Reports.—Messrs. James Forster & Co., reported on January 31st:—

> Early lead was adversely affected by shipments made by the Government from Liverpool to London, the market being unprepared for same. The strength of the position of the metal, however, has been clearly shown by the following days' markets, each day showing an advance until on Thursday £47 7s. 6d. was paid for January and February, £47 10s. for March, and up to £48 for May. There is no favourable news as to the position in Australia, and little chance of getting any material supplies from Spain. For some weeks now consumers have been buying very little in the hope of getting easier conditions, but, notwithstanding a free liquidation of "bull" accounts, we have had no set-back.

Messrs. G. Cawson & Co. on January 31st reported:—

> There has again been a moderate inquiry from consumers, and also some little trade for export. The bulk of the business done, however, has again been almost entirely speculative. The position as to supplies remains unchanged; there is at present plenty of lead available for all requirements. Arrivals during the month have not been quite so heavy, but as Australian lead is still coming forward regularly and very considerable sales of Mexican bonded lead have been made, to come forward during the next two or three months, there seems to be no question as to any shortage in supplies. With the present high prices now ruling and also the record price of silver, Mexico and other countries will certainly increase their output. . . . Definite information as to the Spanish production and prospects of future output is difficult to obtain. The outlook for the time being seems to be fairly favourable, provided speculators continue to support the market—there is no valid reason why they should not do so, as it is not in their interest to allow prices to break away and go to a lower level.

French Orders for German Electricity Meters.—At its meeting in the middle of December, the Municipal Council of Metz considered the tenders sent in for the supply of 2,000 electricity meters. The French, English, and American tenderers asked for a delay in delivery of nine months to one year, and quoted round sums of 270,000 frs. The A.E.G. of Berlin offered to supply the 2,000 meters in six weeks, and quoted the low price of 165,772 frs. Considering the financial side of the question alone, the Municipality accepted the tender of the German firm. Very naturally the decision has passed under the scathing criticism of our contemporary *l'Electricité*; 1,500,000 killed, 200 milliards of damage and ruins have not, it says, weighed in the decision of these municipal councillors. A saving of 100,000 frs., a little delay in delivery—which it would be ill-beseeming to urge as a fault to the French industry, disorganised by five years of war—have been enough for these Lorraine councillors to prove their ingratitude to the nation's electrical manufacturers, who, throughout the war, have placed their works, their materials, their means, under contribution to save them from the clutches of the Teutons.

Canning's Post-war Re-union.—On Saturday, January 24th the first post-war reunion of principals and employés of Messrs. W. Canning & Co. was held at the White Horse Hotel, Birmingham, Mr. E. R. Canning presiding.

During the smoking concert which followed the dinner, Mr. T. R. Canning, who has resigned from his position as head of the firm, received a presentation from the staff and employés. Mr. R. T. Gosling read the illuminated address, and asked Mr. Canning to accept it, together with a gold cigarette case and wristlet watch.

In responding, Mr. T. R. Canning first extended a hearty welcome to the men who had returned from military service, and voiced sympathy with the relatives and friends of those who had fallen. In thanking all for their kind expressions and present, he said it was nearly 40 years since he went to Birmingham as a youth of 14; a few years after he had completed his apprenticeship he was taken into partnership in what was then a small business. By hard work during long hours, and taking advantage of possibilities, the three partners were able to develop the business. In the middle eighties metal finishing and plating by mechanical means was introduced from the States, and very little was known of the various products used or how they were used. The firm, therefore, had to secure the confidence of manufacturers by putting in plant on trial and taking it back if it did not prove satisfactory. They were the oldest firm making and supplying electro-plating chemicals. Whatever claims might be brought forward, he asserted that Mr. W. Canning was making chemicals for silver-plating immediately after its introduction. Some of those present could recall Mr. John Thornton, to whom he owed his success in the business. He regretted the trend of thought which suggested that an employer's only object was to get all he could out of his employés. That had never been his principle. If a man showed himself capable of filling a better position he always gave him the opportunity when it arose. Many of those he saw around him came as lads. Their present chief, Mr. E. R. Canning, received his business tuition under him, and no one could say that he had not turned out to be a good business man. There was only one real way to success, and that was by hard work either with brain or hand. He did not mean to say that a man should always be at work, but he should work hard when at work and play hard when at play. If he could read the signs of the times the nation would have to work as hard as it had ever done, as he felt sure that in a few years competition would be as keen as it was before the war. His last wish was that employés, staff, and principals should work together, each doing what he could to further the interests of the business. The toast of "The Firm" was proposed by Mr. P. Brotherton.

Mr. T. W. Senier, in seconding, said that so far as the London depôt was concerned, new premises had been obtained which would permit of that section of the business being remodelled. In his reply, Mr. E. R. Canning said that the firm would not have been in its present position had it not been for the part the women had played during the war. They had not found it necessary to discharge a single woman. Mr. Canning remarked that when his brother started the business the staff numbered only half a dozen; when he entered the business it had grown to ninety; and to-day it stood at upwards of six hundred. No fewer than 110 men left them to serve the country, but he was thankful to say that most of them had come through unscathed. Referring to the future, Mr. Canning said they were told the war would bring better conditions, but it seemed to him that during the last few months everything had gone astray. He was afraid we were in for troublesome times ahead, but he was still optimistic, as he believed that Englishmen who put their backs to the wall to win the war would again win through. Before peace and quietness was obtained the cost of living must be reduced. That was the crux of the position, and to reduce the cost of living more goods must be produced. They knew that the output per man could be increased, and while they did not get so much labour trouble as other firms, a solution had to be found to the question of production. If piecework prices were reasonable a man ought to earn as much as he possibly could, and it was up to the employers to see that those prices were not reduced. He appealed to them not to nurse grievances, as they would only grow, but to bring them forward for settlement.

The chairman then presented watches to nine members of the staff who had seen upwards of twenty years' service with the firm. Messrs. G. A. Pope, A. Butcher, and J. Wakefield, three of the recipients of long service awards, suitably acknowledged the firm's gifts, after which the chairman presented to each of the ex-service men present useful gifts as small mementos of the part they played in the war, on behalf of those who stayed at home. Capt. W. R. Pratt returned thanks on behalf of the ex-service employés.

From Recent Speeches.—Sir Auckland Geddes, President of the Board of Trade, has been speaking upon the importance of our reopening trading relations with Germany. In a speech delivered at the Plymouth Chamber of Commerce on Saturday last, he is reported to have warned the traders of the country against the weakness of giving way to international hatreds and spites. He would have thought any man would be satisfied with what we had done to our enemies. "Not as a matter of sentiment, not even as a matter of humanity—leave that out, if you will—but as a matter of plain self-interest, come forward, pick your late enemies up, and try to get them on their feet again. If we do not we shall leave Europe shattered, and the paralysis which has crept over them will creep over our national life, too." They were sometimes told the present Government had no policy, but on the trade side it had a very clear and distinct policy, from which it had never deviated one hair's breadth. That policy was to get the export trade of this country going now.

Here is another straw showing which way the wind is blowing:—

Mr. J. H. Thomas, speaking at the American Luncheon Club: "The first essential to a normal position the world over was to try, if possible, to forget that the war had taken place. Unless credit was re-established and we gave our late enemies an opportunity to work, there was no chance of them making reparation for the wrongs they had done. . . . Instead of having the recriminations of the past, employers and labour must be partners in industry. Each section must re-establish confidence in the other. The fatal difficulty of to-day was that labour mistrusted capital because of the differences of the past, and capital equally mistrusted labour. . . . There would be no solution of the labour problem until both sides trusted each other. . . . He wanted Americans to recognise their obligations to the world."

In one of his Paisley speeches, Mr. Asquith referred to the question of nationalisation. He said that the Labour Party in the long run were committed by their principles as a party to the ultimate ownership, control, management, and working by the State of the whole machinery of production throughout the range of industry. He referred to the great danger that this presented to the innumerable advantages which were derived from the free play of competition, of individual energy, of rival encouragement, from the influx of new processes and new inventions, and new methods of production. He was strongly of opinion that there was need for great and far-reaching reforms in our industrial system. "I think that the voice of Labour, the power of Labour to exercise a control or share in the control of what is, after all, a great partnership, or to the conjoint result of which it contributes in many cases the larger share, the claim of Labour upon that point is a claim which is quite irresistible." There is a third party in these great industrial combinations, whose voice also ought to be heard, and whose hand ought to be felt. That is the State, as representing the consumer. "One of the most formidable dangers, not only to individual liberty, but to the wise and equitable distribution of wealth nowadays, is the danger that springs from the growth of big combinations. They must be kept rigidly under control in the interest of the community at large, and unless kept under control, they will be masters of the community instead of being its servants."

In an address on "Industrial Unrest," delivered at the City Business Club, Glasgow, Mr. William Adamson, chairman of the Parliamentary Labour Party, said there had been too much tendency to put down the whole thing as being the aftermath of the war. He admitted, however, that the evil had been intensified during the five years of war to such an extent that unless a speedy and satisfactory solution were effected the stability of the State might be undermined. . . . During the war the worker was again and again promised, if he did his share in defending the country, that at its conclusion he would be living in a new world. The worker was looking for that promise being redeemed, but was still waiting on the delivery of the goods. As yet he saw very little sign of the promised New Jerusalem. The worker had got tired, and he had made up his mind he would be no longer content to go along quietly acquiescent in a system of industry conducted for the profit of the few. Employers in continuing to act as they were doing were acting foolishly, as they did not seem to realise that the industrial situation was a serious one, and a dangerous one. His own personal opinion was that the best means for effecting a better relationship between the various sections of the people was by evolution along constitutional lines.—*Daily Telegraph.*

Speaking on "A practical ideal for industry," at a meeting in Manchester of the North-western district of the Society of Technical Engineers, Mr. B. Seebohm Rowntree said that science would play an increasingly important part in industry in the future. The terrible wastage of wealth of the past five or six years had to be made up in the least possible time, for wealth was essential to progress; and therefore it was of supreme importance that industry should rapidly increase its efficiency. We could not carry on industry by the old rule-of-thumb methods; we should have to put into it the best brains and the best science that could be applied. The position of the chemist and the engineer was going to be much more important in the future than in the past. We should regard all industry as a form of national service. . . It was all nonsense to talk about over-production. It was impossible to produce too much wealth—what mattered was the manner of its distribution. Eighty shillings a week—representing 35s. 3d. a week in 1914—was the lowest sum on which a man could be expected to carry on a home and bring up an average family to-day, and yet industry in its present state could not stand such a minimum. It was, however, a mini-

mum that should be aimed at, and that it might be secured more efficient production was necessary. In enabling the administrators of industry to produce more economically and efficiently engineers would be doing a great national service. —*Manchester Guardian.*

Sir Auckland Geddes, in a speech delivered on January 29th, said :—One of the greatest problems of the Government of the moment was how, under ordinary economic forces, gold in America could be got to flow across the Atlantic in an easterly direction. Until we do that, we cannot stop with any certainty the rise in the cost of living. There is only one way in which we can get a flow of gold to start from America : we should send across the Atlantic in a westward direction more goods—that is to say, goods of greater value than America is sending to us in the shape of raw materials and food, and if we can once get a bigger stream flowing westward than the values of the goods flowing eastwards, we should at once get a flow of gold eastwards to make up the difference. There was one solution for the present position—and that was that somehow, by hook or by crook, this country must get its volume of production enormously increased. There would then be bigger quantities week by week for export, and as the export of goods began to flow in increasing value, we might look for gold to begin to flow back, and quite a small trickle of gold coming back from the United States would begin to affect the cost of living.—*Financial Times.*

Sun Staff Dinner.—A very successful "Peace" dinner was held by the Sun Electrical Co., Ltd., at the Café Royal, Regent Street, on January 31st. Mr. A. G. Beaver, the general manager, presided, and the directors of the company and a great number of the members of the staff were present. Among the toasts were "Ours, who did their bit in the Great War," proposed by Mr. Beaver, and responded to by ex-Sergt. Wood, who expressed his appreciation of the way the company had dealt with the ex-Service men ; "The Directors" (response by the chairman, Mr. Tweedy Smith) ; "The Indoor Staff," to which Miss Dewdney very ably replied on behalf of the ladies ; "The Outdoor Staff and Agents," and "The Press." In proposing the health of the general manager, Mr. H. C. Weeks presented him with a piece of plate, a cigarette case, and a volume containing the signatures of the subscribers, as an appreciation of his valued leadership. Mr. Beaver spoke in glowing terms of the goodwill existing among all members of the staff, and attributed the company's success, in a great measure, to this spirit. He remarked on the fact that the company's "coming of age" occurred in August next, it having been formed in 1899. A well-arranged concert followed the dinner. Items of great artistic merit were rendered by Miss MayKearsey, Miss Norah Drake, and Messrs. Bret Hayden, Herbert Richards, Wilson Martell, and Max Templeton.

Accumulators in Australia.—The recent decision of the Commonwealth Government to encourage the development of the accumulator manufacturing industry in Australia by prohibiting the importation of secondary batteries except by licence has, judging from the news brought by the last mail, been the cause of considerable discussion. A writer in the last number to hand of the *Australian Motorist* remarks that "those who advocated an embargo on accumulators and batteries were apparently unaware that motor vehicles need them, and the whole of their arguments appeared to be based upon the opinion that electric storage batteries were only required for a few shire and municipal lighting plants, as well as for city electric lighting undertakings. There are upwards of 30,000 motor-cars running in Australia to-day, which are dependant upon specially designed batteries, which have not yet been produced in Australia beyond an experimental stage. The attempts to make automobile batteries in Australia have hitherto proved futile, for the reason that the Australian rubber companies have not been able to produce vulcanite cells, and the business is not sufficiently large for any battery concern to instal plant for making suitable rubber containers. Attempts to construct an Australian-made automobile battery have been abandoned by expert men for the reason that lead and celluloid cells have in past years been abandoned as 'useless' for automobile work, and these are the only cells so far produced in Australia. Those administering the Government Proclamation have eased the regulations considerably, after consultation with the Federal Council of Australian Motor Traders, by allowing motor chassis and cars to come in equipped with accumulators. Batteries not attached to complete cars or chassis can, however, still only be imported under licence."

Trade Announcements.—The Robinson & Hands Electrical Co., Ltd., have extended their premises in Barwick Street, Birmingham, by taking the adjacent building (No. 56), and thus doubling their warehouse and office capacity. Since the Armistice they have bought and equipped a large freehold works at Nechells, Birmingham, where they are manufacturing electric lampholders, fuseboards and accumulator switchboards on a large scale. At Ashton they have a well-equipped shop for the repair of electrical machinery.

The Enterprise Manufacturing Co., Ltd., have this week opened a branch in Bath Lane, Swansea. Telephone No. : Central 863.

Messrs. L. C. Speed and T. Healy, who for some years have been on the engineering staff of the Southport Corporation electricity department, have started in business as electrical and mechanical engineers at Princes Place, Hoghton Street, Southport.

A private limited company—The West Lancashire Electrical Co., Ltd.—has been formed. They desire to receive manufacturers' catalogues, display cards, &c.

French Electrical Companies.—Under the style of L'Electro-Menuiserie, there has been formed at Paris a company for the manufacture and sale, in France and abroad, of wood furniture for electric installations. Its capital is 150,000 fr.

Launched by the Compagnie Française de Constructions Industrielles, and the Société d'Applications du Béton Armé, the Société d'Enterprises de Réseaux Electriques has for objects the erection of transmission lines, and the construction of iron, cement, and wooden standards, more particularly in the regions invaded.

In order to carry out various agreements come to with other companies serving the suburbs of Paris, the Union d'Electricité has decided to raise its capital to 125,000,000 fr. It will absorb the Energie Electrique de la Région Parisienne, paying for the transactions in 20,000 newly-created 500 fr. shares. It will join forces with the principal companies serving the suburbs—the Triphasé, the Ouest-Lumière, the Est-Lumière, and the Rive Gauche company. The new partnership and amalgamation share-capital created for these purposes will amount to 39,800,000 fr., while a sum in specie of 6,901,241 fr. will also be handed over.

The Société Algor is a company just formed at Levallois (Seine), with a capital of 600,000 fr. for the manufacture, purchase, and sale of electric lamps.

The Compagnie des Lampes et Appareils Electriques de Provence has just raised its capital from 600,000 fr. to 1,000,000 fr.

The Société Hydro-Electrique de Lyon has decided to raise its capital from 4,000,000 to 8,000,000 fr.

The Compagnie du Sud-Lumière, one of the companies serving the suburbs of Paris, has raised its capital to 10,000,000 fr., and has issued 20,000 500 fr. bonds.

The Marking of Goods.—The Merchandise Marks Committee are completing their arrangements for taking evidence before proceeding to consider their report. Associations and others who may wish to make representations on any of the matters which the Committee are investigating should communicate with the Secretary of the Committee at the Patent Office, 25, Southampton Buildings, W.C. 2, not later than February 14th.

The Committee, who were appointed by the Board of Trade, and sit under the chairmanship of Mr. Henry Greer, M.P., are dealing in particular with the following questions :—

1. Whether all imported goods, or particular classes of imported goods, should be required to bear on importation, or on sale in this country, a statement as to their origin ; whether the statement should specify the actual country of origin, or should merely indicate that the goods are not of British, or not of United Kingdom origin ; and whether any such requirement should extend to goods trans-shipped in this country, or re-export d from this country, to British possessions and foreign countries.

2. The advisability of encouraging the institution of an Empire mark to denote British origin ; the utility and effect of national trade-marks and other similar collective marks ; and whether any such mark, or marks, if used at all, should be administered by the Government, or by municipalties, or by associations of traders.

3. Whether any and what international action is necessary or desirable to prevent the false marking of goods with indications of British origin, and to protect regional appellations of origin.

A Phœnix Works Reunion.—The employés at the Phœnix Works, Bradford (English Electric Co., Ltd.), brought to a conclusion their activities on behalf of those who left the works to serve with the Forces, by holding a reunion in the King's Hall on January 27th. The Phœnix Relief Fund ceased to be contributed to on January 31st, 1919, when there was a balance in hand of £1,773. The sum of £20 only had been spent in the working of the scheme, and 12 persons were still getting relief. Of these seven were still serving with the Forces. A musical programme was given, after which the rest of the evening was taken up by dancing.

Dissolutions of Partnership.—Park Electrical Engineering Co., electrical and mechanical engineers, Westinghouse Road, Trafford Park, Manchester.—Messrs. W. J. R. Fox, G. L. Brown, and H. C. Jones have dissolved partnership. Messrs. G. L. Brown and H. C. Jones will attend to debts.

Riches & Reeves, milliners, art dealers and electrical contractors, 36, Harrington Road, South Kensington, S.W.—Messrs. V. Riches and H. A. Reeves have dissolved partnership. Mr. V. Riches will attend to debts.

Bankruptcy Proceedings.—C. Hellyar (A. Parker and Co.), electrical engineer and contractor, East Sheen.—First and final dividend of 3s. in the £, payable February 16th, at 132, York Road, S.E. 1.

Calendars.—From Messrs. J. Hopkinson & Co., Ltd., of Huddersfield, we have received a handsome wall calendar. Large daily slips, with red figuring, are mounted on a stout card showing Hopkinson valves in process of manufacture.

Messrs. Robt. W. Blackwell & Co., Ltd., of 36, Emperor's Gate, South Kensington, S.W. 7, have prepared a wall calendar comprising six two-monthly sheets, each of which has a humorous illustration, in colour, by Lawson Wood, giving advice gratis. Some desk blotting slips have also been received.

South African Electrical Imports.—The imports of electrical materials and machinery into South Africa during the nine months ending with September last attained a value of £741,755, as compared with only £372,305 in the corresponding period of 1918.

German Trade with India.—The *Daily Telegraph* publishes a message from Bombay, dated January 28th, stating that the German invasion of the Indian market has begun. "The first shipload of German goods arrived to-day, consisting principally of glassware. Many Indian firms have received direct invitations to open up trade with Germany, and India is also exporting goods to Germany. During the last few weeks she has sent her large quantities of cotton."

A.S.E. and Amalgamation.—After expending over £7,000 on the delegate meeting, held in Manchester, to alter their rules, the Amalgamated Society of Engineers now find that all this was unnecessary, because of the new scheme to amalgamate the Unions connected with the engineering and cognate trades. The new Society, to be known as the Amalgamated Engineering Union, will come into existence on July 1st.—*Daily Dispatch.*

Electrical Trade with Scandinavia.—Mr. Montagu Villiers, Commissioner in Scandinavia for the Overseas Service of the Federation of British Industries, was in Birmingham last week, and interviewed many Midland manufacturers upon the possibility of trade with that country and Denmark. He emphasised that great use is made of water power electrically, and that at the present time unique opportunities are afforded for the development of trade in electrical engineering and accessories.

The Beama Rebate Proposals.—At Ilford Electricity Committee the electrical engineer submitted two letters from Mr. D. N. Dunlop (Beama) upon the subject of (*a*) rebate arrangements for inclusive purchase of electrical plant; and (*b*) rebate arrangements for non-inclusive purchase of electrical plant, the object of the arrangement being limited to the purchase for use of machines in Great Britain and Ireland, the Isle of Man, and the Channel Islands only. The electrical engineer further reported as to the objects sought to be achieved by the proposals set out in the letters referred to, such proposals being authorised by a schedule of firms appended to the communication, and including a number of manufacturers and sellers of electrical plant in this country. Before coming to any decision on the suggestions set out in the above letters, the Committee instructed the clerk to report upon the legal position.

Callender's Hospital Fund.—The seventeenth annual report of Callender's Hospital and Distress Fund was submitted and approved at the general meeting, held on January 31st, at the Belvedere Works, Sir Tom Callender presiding. The penny weekly subscriptions realised £346 at Belvedere, and during the early months of the year £16 at Picardy Works—total, £362, against £394 in 1918. Callender's Co. gave a donation of £50, and directors and others donated a further 23 guineas. To hospitals and other institutions there was distributed £376. The report showed the number of hospital and convalescent home letters, surgical appliances, spectacles, &c., issued, and the number of cases in which financial assistance had been rendered.

Private Meeting.—J. W. H. Calcott, electrical engineer, trading as the Western Engineering Co., 8, Lansdowne Road, and 87A, London Road, Sheffield.—The creditors interested herein were called together last week, at the offices of Messrs. Poppleton, Appleby & Turner, chartered accountants, of 155, Norfolk Street, Sheffield. According to the statement of affairs submitted, the ranking liabilities amounted to £1,587, of which £963 was due to the trade, while there were cash creditors for £150 and a bank overdraft for £473. The assets were estimated to realise £2,183, from which had to be deducted £67 for preferential claims, leaving net assets of £2,116. The estate thus disclosed a surplus of assets over liabilities of £530. Mr. C. Turner explained the statement in detail, and said that the cash claims all appeared in the books, and were in order. If the creditors agreed to the matter being dealt with under a deed of assignment, Mrs. Calcott would satisfy the claim of the bank. Under the circumstances, it appeared that all the creditors would be paid in full. Negotiations had already been entered into for the sale of the assets. After a short discussion, the creditors decided that the estate should be dealt with under a deed of assignment, with Mr. Turner as Trustee, and a Committee of Inspection was also appointed, consisting of the representatives of the General Electric Co., Sheffield; Metropolitan-Vickers Electrical Co., Manchester; Messrs. Drake & Gorham, London; and Mr. Albert Carr, Sheffield.

The Plata Telegraph and Telephone Co.—It is reported that the German South American Telegraph Co. has received an offer to take over the company's share-holding in the Compania Telegrafico-Telefonia de la Plata, of Buenos Ayres. It appears that the German banking group associated with the former company acquired about 84 per cent. of the capital of the Argentine company in 1911, and thereby obtained control of the company, which has a share capital of 500,000 pesos, and maintains services between Monte Video and Buenos Ayres. Between 1907 and 1911 the latter's dividends averaged 13 per cent., and in 1912 a rate of 5 per cent. was paid, but nothing has been distributed from 1913 to 1917 inclusive. As a consequence, the German company has formed a reserve fund against this investment, which amounted to 980,000 marks at the end of 1917.

The Belgian International Co.—It is stated that the Compagnie Internationale d'Electricite has concluded arrangements with a French and English group, which assure to the former a monopoly of the systems of the English Electric Co. (Dick-Kerr) for Belgium, Holland and Luxemburg, particularly for traction plant and the conversion of railways to electric locomotion.

The Board of Trade.—The re-organisation of the Board of Trade has been proceeding since June last. It is now announced that the duties of the Department are organised under two joint permanent secretaries: Sir Sydney Chapman, K.C.B., who deals with all questions affecting general policy; and Mr. H. A. Payne, C.B. (Controller), who deals with Administration and Finance. There are among the principal permanent Departments:—

Commercial Relations and Treaties.—Mr. H. Fountain, C.B., C.M.G. (Assistant Secretary).
Industries and Manufactures.—Mr. P. W. L. Ashley, C.B. (Assistant Secretary).
Industrial Property (including Patent Office).—Mr. W. Temple Franks, C.B. (Comptroller-General).
Power, Transport and Economic.—Mr. H. F. Carlill (Assistant Secretary).
Bankruptcy.—Mr. J. G. Willis, C.B. (Inspector-General).
Companies.—Mr. H. M. Wincarls, O.B.E. (Comptroller).
Statistics.—Mr. A. W. Flux (Assistant Secretary).

The following are among the temporary Departments which at present form part of the Board of Trade:—

Profiteering Act Department.—Captain H. Hincks (Controller).
Export Credits Department.—Mr. L. A. Davis (Manager).
Clearing Office for Enemy Debts.—Mr. E. Spencer Grey (Controller).

The Department of Overseas Trade is under the joint control of the Foreign Office and the Board of Trade, its Parliamentary head, Lieut.-Col. Sir Hamar Greenwood, Bart., K.C., M.P., being an additional Parliamentary Under-Secretary of State for Foreign Affairs, and an additional Parliamentary Secretary to the Board of Trade. The permanent head of the Department is Sir W. H. Clark, K.C.S.I., C.M.G. (Comptroller-General). The principal sections of the Department are:—The Foreign Division, the Empire Division, the United Kingdom Division, the Exhibitions Division, the Overseas Services, and the Home Establishment Branch. Sir F. G. A. Butler, K.C.M.G., C.B., acts as Director of the Overseas Divisions. The overseas work of the Department in the collection of commercial intelligence is performed in foreign countries by the Commercial Diplomatic Service and the Consular Service, and in the overseas portions of the British Empire by the Trade Commissioner Service.

The Board of Trade are at present responsible for the organisation of the Coal Mines Department, which is attached to, but does not form part of the Board of Trade, and the President has arranged that Mr. W. C. Bridgeman, M.P., Parliamentary Secretary to the Board of Trade, shall act on his behalf in all respect matters relating to coal, subject to the authorisation of the President on questions calling for his decision. Mr. A. R. Duncan is Coal Controller, and the principal sections of the Coal Mines Department under the Controller, are as follows:—Production, trade, finance, household fuel and lighting, secretariat.

The President of the Board of Trade has established an internal Administrative Council which meets regularly and frequently to deal with current business involving questions of policy.

The Administrative Council here referred to is quite distinct from, and in no way supersedes, the Board of Trade Advisory Council, on which manufacturers, traders, and labour are represented.

Catalogues and Lists.—Messrs. Alloy Welding Processes, Ltd., 14-16, Cockspur Street, S.W. 1.—*Bulletin* No. 24, a report on electric arc and oxy-acetylene welding tests carried out by the National Physical Laboratory, Teddington. *Bulletin* No. 27, illustrated price list and particulars of "A. W. P." electric arc welding plant. *Bulletin* No. 30, statement of tests applied, and results obtained, with "A. W. P." welding electrodes by the Admiralty at Portsmouth Dockyard. *Bulletin* No. 31, descriptive list and prices of oxy-acetylene welding rods and electrodes for arc welding. *Bulletin* No. 32, illustrated results of tests of "A. W. P." electric welding for Lloyd's Register of Shipping.

Messrs. Ferranti, Ltd., Hollinwood, Lancashire.—Six catalogues (14 pp.) dealing with "Ferranti" house-service meters, switchboard instruments, and static transformers. These lists, which are fully illustrated, are identical, but in English, French, Italian, Spanish, Portuguese and Danish, and Messrs. Ferranti inform us that a Dutch translation is being prepared. All dimensions, &c., in the English edition are metric.

The General Electric Co., Ltd., Queen Victoria Street, E.C. 4.—Installation Leaflet D 17, describing the electrification of the works of the Halesowen Steel Co., Ltd., near Birmingham; illustrated by photographs of the works.

Messrs. H. T. Boothroyd, Ltd., Akenside Street, Bootle, Liverpool.—List of electric motors and dynamos (16 pp.), giving prices, dimensions, &c.; illustrated.

The Lea Recorder Co., Ltd., 28, Deansgate, Manchester.—Technical Booklet (Civil Engineers' Edition), "Q 5" and leaflets "Q 6" and "S." The booklet provides information regarding the measurement of streams and rivers, sewage, supplies to reservoirs, &c., and contains illustrations of actual machines at work, indicating the various types of recording instruments required. The leaflets describe and illustrate the "Lea" recorder.

The Peerless Engineering Co., Cote Hill, Halifax, Yorks.—A descriptive catalogue (16 pp.) of the "Peerless" car lighting and starting systems. Priced and illustrated.

The Esterline Co., Indianapolis, U.S.A. Two copies of the "Esterline Graphic" advertising graphic recorders and permanent magnets.

Glassware Testing.—A new building for the testing of volumetric glassware has recently been completed at the National Physical Laboratory. A pamphlet entitled "Volumetric Tests for Scientific Glassware" was published in November last, giving information regarding methods of test, tolerances, test fees, &c. This may be obtained free of charge from the Director, National Physical Laboratory, Teddington, Middlesex.

Copper and Lead Prices. — Messrs. James and Shakespeare report February 4th English pig-lead £48 15s., an increase of 20s. for the week. No changes are reported in copper.

Dance.—The Cryolite Athletic Association (London Staff of the British Aluminium Co., Ltd.) held a Fancy Dress Dance at the Cannon Street Hotel on Saturday last. Over 200 dancers, mostly in gay array, spent a thoroughly merry evening. Mr. W. Murray Morrison (president), and Mrs. Morrison, Mr. A. W. Tait, O.B.E. (chairman of the company), and others prominent in the aluminium world were present.

Book Notices.—"Mathematics for Engineers," Part II. By W. N. Rose. Pp. xiv + 419, 142 figs. London: Chapman and Hall. Price 18s. 6d. net.

"Beama." The Beama Journal, Vol. vi, No. 1, January, 1920. London: Oakley House, Bloomsbury, W.C. Price 1s. 6d. net.

"Despositivo para Hogares." By José Cervera Alsina, Paseo Alfonso XII, 25, Vigo, Spain. A pamphlet describing a method of facilitating the combustion of small coal.

"The Speed of Electricity." By A. E. Kennelly, D.Sc., A.M. 7 pp. A reprint from *The Wireless Age*.

"Alternating-Current Planevector Potentiometer Measurements at Telephonic Frequencies." By A. E. Kennelly and Edy Velander. 36 pp. Massachusetts Institute of Technology.

"Vickers News." Vol. I, Nos. 7 and 8. London: Vickers, Ltd.

"Pitman's Business Man's Encyclopedia and Dictionary of Commerce." Part I. London: Sir I. Pitman & Sons, Ltd. 1s. 4d. net.

"Foster's Pocket Reference Books." We are asked to state that the full address of the publisher of these books (reviewed in our last issue), is 98, College Road, Whalley Range, Manchester.

Patents and Designs Acts.—The Sections of the Acts of 1907 and 1919, dealing with the power of the Crown to use inventions and to dispose of such articles as are no longer required by the Crown, came into operation on January 21st.

The Economic Position.—"Stability as the Basis of Industrial Peace," is an eight-page pamphlet containing a reprint of an article written for *Ways and Means* by Mr. E. W. Petter (of Messrs. Vickers-Petters, Ltd.) The pamphlet is issued by the Industrial League and Council, 82, Victoria Street, S.W. 1, and a copy will be sent to anybody interested in exchange for two penny stamps to cover postage. Whatever Government we may have, we shall all have to face the economic issue. Governments are helpless; the only remedy for the present situation is for us to export manufactured goods. The author suggests the stabilisation of wages for a fixed period—say a year—unrestricted production, and real national unemployment insurance. Prices continue to soar; if ships fetch meat from South America, and they return in ballast empty, we pay double freights for one cargo. Everybody must get to understand the present position, and the peril of it. The circulation of literature of this kind, at a time when the serious rate of exchange problem is before all the nation, may do something to avert disaster if only it is read and believed by the right people.

Metal Prices and Cable Tenders.—The sudden rise in the copper and lead markets resulted in the Dundee Corporation having to pay £1,975, or 17½ per cent. increase in the cost of cables, and at a meeting of the Electricity Committee, it was agreed to recommend that the engineer be given power to notify acceptance of tenders immediately, in order to lessen the risk of the markets rising.

Conference of Manufacturers and Producers.—A National Conference of manufacturers and producers will be held at Kingsway Hall, London, W.C. 2, for two days, commencing at 10.30 a.m. on February 10th. Mr. W. Peter Rylands (president of the Federation of British Industries) will take the chair, and the deputy chairman will be Mr. E. Manville, M.P. (president of the Association of British Chambers of Commerce). The following well-known organisations will be taking part in the proceedings:—The Association of British Chamber of Commerce, National Confederation of Employers Organisations, Coal Association, British Engineers' Association, National Federation of Iron and Steel Manufacturers, Glass Bottle Manufacturers' Association, Chemical Manufacturers' Association, British Empire Producers' Organisation, and the British Commonwealth Union; also the big textile associations. The following are the subjects down for discussion on the first day after the chairman's opening speech:—Export trade and foreign exchanges, prices and profits, Government finance and expenditure. The subjects for discussion on the second day will be:—Nationalisation, transport, fuel, education, research, and housing.

Socials.—A social, organised by the Blackpool Electricity and Tramways Institute, was held on January 28th. There was an attendance of about 1,000.

After a war-time lapse of four years, the 150 trolley boys in the Salford Tramways Department were entertained by the Committee last week, Alderman Linsky presiding. Mr. G. W. Holford, general manager, and Mr. W. Blakemore, traffic superintendent, were also present.

French Trade Combination.—After having constituted, at the end of 1918, the Union des Syndicats de Ingénieurs, comprising the three syndicates of chemical engineers, electricians, and mechaniciens, the Union is proceeding a step further, and aims to form a Federation of Technicians, whose object will be, while leaving to each syndicate the care of its own special interests, to co-ordinate the efforts of all the syndicates for the general welfare. A conference was recently called in Paris, with the view of incorporating this Fedération des Technicians de l'Industrie.

LIGHTING AND POWER NOTES.

Barrow.—Loans.—The Town Council has considerably exceeded its borrowing powers in providing additions to the electricity plant, and further extensions are necessary. Application is therefore being made to the Electricity Commissioners for increased borrowing powers.

Birmingham.—Extensions. — The demands of prospective consumers will entirely absorb the power available from the new station at Nechells, and further extensions are thought necessary.

Blackburn.—Mains Extensions.—The Town Council is applying for sanction to borrow £130,000 for laying additional mains in connection with the new generating station at Whitebirk, and three housing schemes, together with provision for power consumers and future extensions.

Bolsover (Derbyshire).—Electricity Supply.—The Urban District Council is approaching the Stanley Coal and Iron Co., Ltd., to ascertain the terms upon which it would be prepared to supply the district with electricity for lighting, &c.

Bradford-on-Avon.—Time Extension.—The Board of Trade has extended the time for effecting the transfer authorised by the Bradford-on-Avon Electric Lighting Order, 1914, until July 30th, 1920.

Bury.—House Lighting.—The electrical engineer has been instructed to proceed with the installation of the cables for the new Walmesley housing scheme.

Canada.—Water Power.—At a Deep Waterways Convention at Winnipeg a resolution was adopted in favour of the reconstructing the St. Lawrence River with locks, so as to supply navigation facilities equal to those of the Welland Canal, and the public ownership of all water power available on Canadian waterways.—*The Times.*

Colne.—New Plant.—The Town Council has received the report of the deputation which waited upon Sir John Snell, Chief Electricity Commissioner, regarding the position of the electricity undertaking. Sir John sanctioned the installation of a turbo-alternator and an additional water-tube boiler to provide for next winter's demand on the understanding that arrangements for inter-connection between Nelson and Colne were still to hold good. The tender of the Stirling Boiler Co., for the supply of a water-tube boiler, including steam pipes and feed pump, at £4,443, was accepted, and a 2,000-kw. turbo-alternator is to be purchased from Stockport Corporation for £10,000. A scheme for the erection of a sub-station in Dockray Street is to be proceeded with, and application is being made for additional borrowing powers to the extent of £20,000.

Continental. — Italy. — According to the American Consul at Venice, the hydro-electric industry of Venice is chiefly under the control of a financial group headed by the Società Adriatica di Eletricità. The "Adriatic" company is endeavouring to provide hydro-electricity to the Julian Veneto, the Trentino, Istria, and possibly to the city of Fiume. It has been announced that a contract has already been entered upon to supply electricity to the commune of Trieste. Although several of the principal generating stations of the Veneto fell into the hands of the Austro-Hungarian invaders during the autumn of 1917, they were finally retaken by the Italians in a much more satisfactory condition than was expected, as the enemy's retreat was so rapid that systematic destruction was not possible.

The Società Idro-Elettricale Monte Viso (with a capital of 25,000,000 lire), is constructing a large station in the upper valley of the Po. The power will be supplied by means of an artificial lake at a height of 900 metres, having a capacity of 25,000,000 cb. metres; 50,000 h.p. will be developed, and power supplied to the works situated in the vicinity, and also to the city of Turin. Prior to the war this district was being exploited by a German firm.

Holland.—The estimated power requirements of Holland, according to the report of a Committee appointed to deal with the question, amount to 1,000,000,000 kw.-hours per annum, allowing 100 kw.-hours per head for a probable future population of 10,000,000. The system of generation proposed is by means of central stations erected in carefully-selected localities, such as Amsterdam and Rotterdam, capable of supplying 75,000 kw. each. A national scheme is recommended, under the supervision of a Government Council.

Germany.—Owing to coal shortage, the Maschinen- u. Dampfkessel-armaturen-Fabrik Schaeffer und Budenberg G.m.b.H., Magdeburg, has been obliged to stop work at three foundries. The closing down of the whole undertaking is to be reckoned with shortly, whereby 2,600 persons will be thrown out of work.—*Economic Review.*

A similar measure to the British Electricity (Supply) Act is shortly to be introduced, which will divide the country into districts under corporations, for supply purposes, the whole being controlled by the State.

Switzerland.—The *Basler Nachrichten* states that the whole course of the Reuss from the Schöllenenschlucht to Amsteg is to be used for generating electricity. The firm of Escher, Wyss and Co., of Zürich, and the Swiss Military Department are interested in the scheme, the latter having obtained a concession for the upper portion of the Schöllenen in order to provide the Gotthard forts with electric power.

Cork.—Transfer of Undertaking.—The Corporation, pursuant to the Cork Electric Lighting Order of 1896, is seeking the consent of the Electricity Commissioners to transfer its powers, duties, and liabilities to the Cork Electric Tramways and Lighting Co., Ltd. The period for which such transfer from the Cork Corporation to the Tramways and Lighting Co. is to be made is 40 years, the company undertaking (*inter alia*) to expend a sum of £20,000 within three years on the purchase of new plant and buildings, and to undertake the proper and adequate maintenance of the electric tramway service in Cork City and the lighting and power supply.

Coxhoe (Co. Durham).—Electric Lighting.—In connection with the proposed joint electric lighting scheme, a meeting of representatives of the Coxhoe, Hassop, and Kelloe District Councils has decided to ask Messrs. W. Scott, Ltd., and Messrs. Bell Bros., colliery proprietors, who have offered to provide and erect poles, lamps, &c., and supply power in their respective districts at a charge of £5 per lamp per annum, to submit drafts of agreements for confirmation by the respective Councils and the joint body.

Derby.—Inquiry.—On January 30th, an inspector of the Ministry of Health held an inquiry into the application of the Corporation for loans of £3,803 for the purchase of property to be used as offices, showrooms and workshops, and £2,500 for the erection of a garage. The electrical engineer stated that his department sold a large quantity of electrical fittings, and the buildings would prove of considerable value.

Extensions.—The Electricity Committee has recommended the borrowing of £15,000 for mains extensions, £1,000 for motors, and £1,200 for an electric delivery vehicle. It is estimated that a total of £140,000 will eventually be required, £35,000 of which will be expended during the ensuing financial year.

Edinburgh.—Extensions.—The Electricity Committee recommends an expenditure of over £60,000 on extensions. The proposals include two additional boilers for the Dewar Place station, and a 2,500-kw. turbo-alternator for the M'Donald Road station, as well as the installation of feeder cables in outlying districts.

Glasgow.—Mains Extensions.—The Clyde Valley Electric Power Co. has intimated that it is willing to extend its mains to Giffnock, if a minimum income is guaranteed.

Ireland.—Water Power.—Many Irish towns are making inquiries regarding the cost of electricity, and find that generation is too costly in several cases. The recent heavy floods of the Shannon, Bann, and other rivers, suggest to the public that there is a very great amount of water power that can be developed, but the minimum flow, on which estimates must be based, leads to a very different conclusion. The Irish Water-Power Resources Committee is conducting exhaustive inquiries into the matter.

Kilmarnock.—Year's Working.—The accounts for the year ended May 15th, 1919, show that the total revenue was £59,576, and the expenditure £35,529, leaving a gross profit of £24,047. After payment of loan interest, &c., the net profit was £5,858, as compared with £5,475 for the previous financial year.

King's Langley.—Mains Extensions.—The Council has asked the Watford Electric Lighting Co. to obtain powers to extend its mains to the parish.

Leeds.—Extensions.—The Corporation is contemplating a big development scheme at an early date. Besides additions to buildings and the installation of generating plant, a considerable extension of the mains is to take place. The whole of the scheme will cost three-quarters of a million sterling.

London.—St. Pancras.—The electrical engineer has recommended mains extensions at an estimated cost of £5,450.

The Council has agreed to pay Messrs. Bruce, Peebles & Co., Ltd., £400 above the contract price for the 1,000-kw. motor-converter installed at the Tavistock Place sub-station a short time ago.

Bethnal Green.—The Borough Council has applied for sanction to borrow £20,011 for the installation of mains (£17,033), meters (£1,300), and house services (£885).

Supply Failure.—All public and private electric lighting in the area with Piccadilly Circus as its centre, failed at 8 p.m. on Tuesday night for about 15 minutes. The interruption in the supply was caused, it is reported, by the breakdown of a generating set in the power station of the St. James and Pall Mall Electric Light Co.

Reigate.—Expert Advice.—The Town Council has asked Messrs. Handcock, Dykes & Trotter to report upon the systems in vogue for encouraging the use of electricity by owners and occupiers of cottage property by free wiring, upon deferred payment systems, or otherwise, and upon various methods of supply.

Sligo.—Lighting Scheme.—A scheme for lighting the town by electricity has been proposed. Councillor Jackson is taking steps to secure the use of water power for the purpose.

Stalybridge.—Deficit.—In order to cover an estimated deficit of £3,000, the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board has decided to make a levy of £750 upon each of the constituent Corporations. The total loss on the undertaking since its inception in 1901 is stated to be £110 000.

Tasmania.—Hydro-Electric Developments.—The Minister of Public Works reports that 70,000 h.p. is available from the Great Lake supply. It is proposed to develop this by means of a 12,000-h.p. plant near the present intake, and a 58,000-h.p. station at Waddamana. Much of the machinery for the latter plant has already been ordered, and 26,000 h.p. will soon be available. The scheme includes the erection of five sub-stations to be situated at Risdon, Hobart, Launceston, Electrona, and Bridgewater. The estimated yearly profit is £3,300.

Tidal Power.—It is reported in the daily Press that work is about to begin in an attempt to harness the tidal power on the Dee and Severn. It is stated that models have been set to work within the last few months, from the working of which it is estimated that electrical energy can be produced in this manner at a cost of ½d. per unit.

West Ham.—Loan Sanction.—The Town Council has received sanction to loans amounting to £140,317 for electricity purposes.

Whitehaven.—Price Increase.—The Town Council has advanced the price of electricity for power supplied to factories by 10 per cent.

TRAMWAY AND RAILWAY NOTES.

Barrow.—New Cars.—The tramway manager recommends the purchase of 10 new cars in order to provide an adequate summer service.

Blackpool.—Year's Working.—Blackpool, St. Annes, and Lytham Tramways Co., in its annual report, states that the total traffic receipts were £67,409, out of which £22,342 was paid to the Corporation of Blackpool. Traffic expenses amounted to £15,509, and, after other expenses had been met, there was a balance of £10,094. During the year negotiations proceeded with St. Annes Urban District Council for the purchase of the undertaking, resulting in an offer by the Council of £135,000. A preliminary agreement has been entered into, and approved of by the stockholders and shareholders. The St. Annes Council will promote a Bill in the next session to carry out the agreement.

Burnley.—New Cars.—The Town Council is purchasing five additional single-deck cars at an estimated cost of £16,000.

Brighouse.—Opposition to Bill.—The Town Council is opposing the Parliamentary Bill promoted by the Halifax Corporation, which, among other things, proposes to extend the latter authority's powers over the tramways by 30 years.

China.—Railless Freight Line in Shanghai.—Negotiations are said to be in progress between the Shanghai Tramway Co. and the Municipal Council of Shanghai for an extension of the present railless traction facilities. If the necessary street improvements are made and three wooden bridges replaced with steel structures, a freight service will be introduced connecting the railway freight station in Chapei with the Yangtzepoo district. The new freight cars will be provided with storage batteries, enabling them to make side trips into the yards of manufactories. These plans involve the addition of from 12 to 13 miles of new routes to the present system, requiring about three years for completion.

Continental.—Hungary.—A group of Belgian financiers has made an offer to purchase the Budapest tramways. It is probable that the offer will be accepted, since the two tramway companies in the city were socialised under the Soviet régime, and show a deficit of Kr. 150 mill.—*Economic Review.*

Italy.—The decision of the Government to organise the electric conversion of some 6,000 kilometres of railways (either directly or through private initiative under State control) will involve the placing of large orders abroad for rolling stock and other material which the Italian industry will be unable to supply. The material will comprise turbines, dynamos, transformers, conductors, insulators, posts, standards, &c., to carry distribution lines, trolleys, motors, measuring apparatus, &c. The general plans for the electrification of the railways rest with the Italian Ministry of Transportation, which is advised by a Commission for Railway Electrification. New hydro-electric stations, extensions to existing plant, new transmission lines, sub-stations, electric locomotives, and all kinds of accessory plant and equipment will be required, much of which will have to be imported. The system so far employed is three-phase, 16 cycles. On mountain lines, locomotives with direct-connected motors, with power applied to all the wheels, have been employed with success. The general speed was 38 miles an hour, or about 19 miles per hour when hauling trains of 500 tons on 30 to 35 per cent. gradients.

Dublin.—Tramway Ownership.—The Corporation is considering the municipalisation of the tramway system, which is at present undertaken by a company, to which the track is leased.

Halifax.—Carriage of Minerals.—A majority of ratepayers has approved the Bill, which (*inter alia*) will enable the Corporation to utilise the tramways for the conveyance of minerals and other goods

Huddersfield.—Extensions.—The extension to Longwood is being proceeded with. The scheme for the construction of a railway from the Midland Co.'s premises to the gas and electricity works has been abandoned.

Kilmarnock.—Year's Working.—The total revenue for the year ended May 15th, 1919, was £14,178, and the total expenditure £12,539, representing a gross profit of £1,639. The net result, after payment of interest, &c., was a deficit of £2,483. The loss on the working for the previous year was £3,356.

London.—At the meeting of the East London Railway Co., Mr. Murray Griffith said that the increase of passengers since the electrification had far exceeded the expectation of the directors. In 1912 they were carrying, under various difficulties, about 4,500,000 passengers, and in 1918 they carried 10,569,000. During December last they carried 1,275,000 passengers, which was over 15,000,000 per annum. They had brought the line to the position of being a necessity, in that it afforded a link for traffic crossing London. The Government, in taking over the line, stipulated that it should be handed back in the same condition in which it was received. It seemed to him impossible that the Government would leave them in the lurch with regard to the interest on the electrification expenditure. When they came out of Government control, he thought they would find their property in the same position as when they went in, plus the fact that since electrification they had established a through service with the main lines both on the north and south sides of London.

The Ministry of Transport has held a conference of Greater London municipal tramway authorities with regard to the financial position of the undertakings.

Maidstone.—Women Employes.—The Corporation, in reply to a local Trades Council deputation, stated that it declined to dismiss the women conductors, as they only required a maximum wage of £2 2s. weekly.

Middleton.—Fare Increase.—On January 29th the Light Railway Commissioners conducted an inquiry into the Tramway Co.'s application for authority to increase its fares. The Commissioners' decision is to be communicated later.

St. Helens.—Extensions.—The borough engineer has been instructed to invite tenders for the supply of 350 tons of rails and the necessary material for the construction of 10 loops.

New Cars.—The tramway manager reports that work on the new cars has been delayed on account of failure in the supply of material.

Fares.—The Tramways Committee is seeking powers to increase workmen's fares from ½d. to 1d. per mile.

Yorkshire.—Storm Damage.—During the recent storms the Huddersfield tramway service was severely handicapped by the accumulation of snow, and in the Spen Valley townships many of the services were entirely dislocated.

TELEGRAPH AND TELEPHONE NOTES.

"Admiralty" Lines.—A conference was held in the office of the Scottish Board of Health recently under the chairmanship of Sir George McCrae, chairman of the Board. Representatives of the Board of Health, the Board of Agriculture and Fisheries, the Education Department, the Ministries of Food, Labour, and Pensions, the Meteorological Office, the Air Ministry, and the General Post Office met, at the request of the Secretary for Scotland, to consider the question how far certain telegraph and telephone lines erected by the Post Office for the special use of the naval and military authorities during the war could be retained and adapted for civil purposes. The lines in question are mostly in the Highlands and islands. Some of the lines have already become part of the permanent system of the Post Office, but there are others that are considered to be of much importance from the point of view of improved communications, and especially in connection with medical and nursing services in certain isolated districts and in islands where there are no resident medical practitioners. Arrangements, it is hoped, can be made, with the co-operation of the Post Office, for the retention of the lines that would be likely to serve any really useful civil purpose. The recommendations of the conference will be embodied in a report to the Secretary for Scotland at an early date.

Alsace-Lorraine.—The French telephone system is to be extended, and a new direct line between Strasbourg and Paris will be installed. Hitherto Metz has had no direct telephonic connection beyond Nancy and Mulhouse, and only one as far as Belfort.

Canada.—A wireless telephone system throughout the northern territory of Manitoba, to bring it into touch with the cities of the West, is recommended by the Commissioner.—*The Times.*

Cheap Wireless.—At a meeting of the Wireless Society of London, held at the Institution of Civil Engineers, on January 29th, Mr. R. C. Clinker, of the British Thomson-Houston Co., showed a wireless receiver which can be installed in the home for about £30. The apparatus, which will take messages from all the principal wireless stations in Europe, is contained in a box 15 in. wide, 12 in. broad, and 5 in. deep, and light enough to be carried by a leather handle. Mr. Clinker explained that this portable receiver was originally intended for receiving time signals from Paris, and for the use of clock-makers and others, to whom a knowledge of the exact time was of importance. No external aerial wire is required.—*The Times.*

Denmark.—A dispute in the Danish telephone industry is in progress. The companies which hold State concessions have based their wages offer on the State Wages Law of September 12th, 1919, while the Central Organisation of Telephone Workers demand rates approaching those paid in private concerns. The Copenhagen Telephone Co.'s proposals would involve an annual expenditure on wages of Kr. 8 million, or Kr. 80 per subscriber; the workers' demands would mean a wages bill of Kr. 13.7 million, or Kr. 137 per subscriber. A strike was declared at midnight on New Year's Eve, involving some 4,000 workers, of whom 2,000 are in Copenhagen.

Germany.—A large and representative meeting of the German Press organisations met the postal authorities on December 22nd to discuss the results of some months of tentative experiments in the matter of disseminating news to the various agencies by wireless telegraphy, and came to the conclusion that in its present state wireless telegraphy could not meet the needs of the Press. On the other hand, it appeared suitable for dispatching generally interesting news in duplicate. The assembly was also of opinion that dispatch of such news could take place to a large extent if wireless telegraphy were replaced by wireless telephony to obviate the necessity for appointing special wireless telegraphists. The assembly will meet again in a few weeks to report on the further development of experiments with telephony.

Elektriska Industri A.-B., in Stockholm, and the Berlin firm Dr. Erich F. Huth Gesellschaft für Funkentelegraphie, have come to an agreement as to a mutual exchange of patent rights in connection with wireless telegraphy and telephony. The agreement is expected to prove of great value to Sweden, especially as regards wireless telephony.—*Economic Review.*

New Swedish-American Cable.—It is announced from Stockholm, says the *Economic Review*, that a group of Americans intend to lay a direct cable between the U.S.A. and Sweden.

Newfoundland.—A company has been formed in Newfoundland to install a new telephone system, to give a service to the city of St. John's and long-distance service between St. John's and various points in Conception Bay and Ferryland district. This is a long-felt want, as the service in this city at present is totally inadequate. The capital for this enterprise is placed at $200,000 common stock and $200,000 preferred. An attractive offer is being made of a 7 per cent. preferred stock, which has an additional advantage of sharing with the holders of the common stock in the surplus earnings of the company over the guaranteed 7 per cent.

Storm Damage.—The storm of January 28th did considerable damage to the telephone and telegraph lines all over the country, especially in the North and Midland Counties. Overhead communication between several large towns and London was interrupted; between Durham and Stafford many miles of wire came down, and only two or three out of the 25 telephone lines between London and Manchester were working. The telephone dislocation quickly showed itself on the automatic system at Leeds, where about 1,000 lines were out of use the next morning. Bradford Exchange was out of touch with a considerable number of subexchanges. For a time Leeds was almost entirely cut off from outside communication. At Todmorden nearly all overhead lines were down, including 16 trunk services.

United States.—An Act, No. 100-66th Congress (H.R. 9822) has been passed authorising the President to arrange and participate in an international conference to consider questions relating to international communication. The conference is to be held in Washington, and will consider all international aspects of communication by telegraph, telephone, cable, wireless telephony and wireless telegraphy, and to make recommendations with a view to providing the entire world with adequate facilities for international communication on a fair and equitable basis. A sum of $75,000 has been voted for this purpose, but no part thereof "shall be used in entertainment or for the purchase of medals and badges." The Act was approved on December 17th last.

The Chesapeake and Potomac Telephone Co. is preparing plans for the substitution of the automatic telephone for the present system at Baltimore.

West Indies.—The last issue of the *West India Committee Circular* contains a leader on the condition of telegraphic communication in the West Indies. Interruptions to cables have been frequent of late, and some of the islands and British Guiana were for a period completely isolated. Strong complaint is being made.

Wireless Telephony in Germany.—The German Commonwealth Post Office authorities, in conjunction with the firm of C. Lorenz & Co., have been conducting wireless telephony experiments between Berlin and Constance which have had very satisfactory results. It is hardly likely, however, says the *Deut. Allg. Ztg.*, that it will be possible for technical reasons to introduce wireless telephony for general use at present.—*Economic Review.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Aberdare.—Urban District Council. Electricity and Tramways Department. Stores for 12 months, including cables, meters, joint boxes, electric lamps, &c. (See this issue.)

Aldershot.—February 17th. Urban District Council. Electricity Department. Geared turbine and generator, condensing plant, pumps, water-tube boiler and superheater, cables, &c. (January 23rd.)

Australia.—MELBOURNE.—March 30th. City Council. 12,000 metal filament incandescent lamps. (See this issue.)

April 12th. City Council. Two 2,000-KW. rotary converters; H.T. switchgear, 6,600 V.; D.C. switchgear, 600 V. (January 30th.)

ADELAIDE.—February 1st. P.M.G.'s Department. Telephone material (schedules 539 and 540). (January 30th.)

Bedford.—February 21st. Electricity Department. E.H.T. cable and transformers, E.H.T. switchgear. (See this issue.)

Belfast.—February 14th. Tramways Committee. Tramway stores, including electrical accessories, cable, lamps, carbon brushes, trolley wire, &c. (January 23rd.)

Belgium.—February 27th. Municipal authorities of Villers-le-Peuplier (Province of Liege) are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the district.

Bedwas (Mon.).—March 4th. Bedwas Navigation Colliery Co., Ltd. Six months' supply of stores, including electrical goods, &c. (See this issue.)

Bristol.—February 23rd. Electricity Department. One 2,000-KW., single-phase, 2,200-V. turbo-generator, complete with condenser and auxiliaries. (See this issue.)

Chester-le-Street (Co. Durham).—March 3rd. Urban District Council. Underground mains and all equipment for lighting district by electricity. F. J. Gray, Clerk, Council Offices.

Edinburgh.—February 9th. Electricity Supply Department. One overhead travelling crane. (January 16th.)

Keighley.—February 10th. Electricity Department. One 900-KW. rotary converter, complete with transformer. (January 30th.)

Kings Lynn.—February 20th. Electricity Department. One Lancashire boiler, superheater, piping, &c. (January 30th.)

Lincoln.—March 2nd. Electricity Department. One automatic battery, for St. Swithin's Power Station. (See this issue.)

London.—H.M. Office of Works. February 13th. Supply of electric cable and wire during period ending December 31st, 1920. (See this issue.)

CAMBERWELL.—St. Giles' Board of Guardians. Three 5-H.P. and 15-H.P. A.C. motors, and one fan. (See this issue.)

Manchester.—February 17th. Tramways Committee. (*a*) Steel girder tramway rails; (*b*) tramcar trucks; (*c*) controllers for tramcars. Mr. J. M. McElroy, General Manager.

February 21st. Corporation Waterworks Committee. Water turbine, dynamo and switchboard, &c.; storage battery, reversible booster, motor generator, switchboard, D.C. motors, starting panels, &c.; L.T. paper-insulated lead-covered cables. (See this issue.)

February 25th. Electricity Committee. Three three-wire balancers, and the necessary switchgear. (See this issue.)

Plymouth.—February 16th. Corporation Transport Department. 20 motor chassis, 20 enclosed omnibus bodies, 11 double-deck tramcars, 100 tons steel rails, six tons fish plates, one motor generator set, one 5 cwt. power hammer. (See this issue.)

Salford.—February 9th. Corporation Tramways Department. Stores for 12 months. General Manager, 32, Blackfriars Street.

St. Helens.—February 7th. Electricity Committee. One steam-driven turbine feed pump. (January 30th).

Warrington.—February 10th. Electricity and Tramways Committee. Two water-tube boilers; two mechanical stokers (underfeed type); water softener. (January 23rd.)

York.—February 27th. Electricity and Tramways Committee. One 3,000-KW. turbo-alternator, with condensing plant; three water-tube boilers, with mechanical stokers, &c. (See this issue.)

CLOSED.

Australia.—SYDNEY.—City Council. Accepted:—
3,000 yd., 3 L.T., "A." class cable, £3,857.—W. T. Henley's Telegraph Works Co., Ltd.
5,000 yd., 25 5,000-V. cable, £5,592.—Noyes Bros.
—Tenders.

Barnstaple.—Trade Council:—
Fire-call installation at firemen's houses.—H. F. James, Exeter, £83.

Colne.—Town Council. In connection with the linking-up with Nelson Town Council:—
Water-tube boiler, including steam pipes and feed pump, £4,443.—Stirling Boiler Co., Ltd.

Coventry.—Board of Guardians:—
Electric installation.—G. R. Marson, Ltd., No. 1 block, £107: No. 2 block, £199.

Croydon.—Corporation. Tender of Mr. S. E. Hunt, Croydon, for electric light wiring of the first 125 houses has been accepted.

Folkestone.—Education Committee:—
Electric installation, Dover Road Schools.—Webster & Son, £94.

Halifax.—Tramways and Electricity Committee. Provisionally accepted:—
One marine-type boiler, economiser, forced draught and induced draught fan, chimney, &c.—Babcock & Wilcox, Ltd., £16,695.
Low tension connections for the 1,500 KW. rotary convertor.—British Thomson-Houston Co., Ltd., £770.

Hammersmith.—Electricity Committee. Recommended:
Mains extensions. Supply of cable, 1,250 yards various sizes, £1,800.—Union Cable Co., Ltd.
1,000 yards each 3-in. single and 3-in. two-way cable ducts, £490.—T. Wragg & Son.
Work in connection with linking-up Fulham and Hammersmith generating stations, £15,905.—W. T. Henley's Telegraph Works Co., Ltd.

Hull.—The Electricity Committee has received the undermentioned tenders for new plant, which have been referred to the City Electrical Engineer to tabulate and report upon:—

CONTRACT 82.
TURBO-ALTERNATOR.

Name.	Price.	Delivery.	Alternator.
Adamson & Co., Ltd. ..	£49,465	14 working months and 10 weeks.	General Electric
Belliss & Morcom, Ltd. ..	£50,414	14 months.	General Electric
British Thomson-Houston Co., Ltd.	£51,619	90 weeks.	—
English Electric Co., Ltd..	£48,484	About 10 mths. after termination of moulders' strike.	—
Fraser & Chalmers Eng. Works	£49,095	14 months.	General Electric
James Howden & Co., Ltd.	£48,020	14 months.	General Electric
Met.-Vickers Elec. Co., Ltd.	£48,290	11 mths. subject to conditions	—
Ateliers de Construction Oerlikon, Switzerland ..	£43,550	16½ months.	—
C. A. Parsons & Co., Ltd...	£50,380	14 months and 2 weeks.	—
Richardsons, Westgarth & Co., Ltd.	£42,965	12 months.	General Electric.

CONTRACT 83.
CONDENSING PLANT.

Name.	Price.	Delivery.
D. Adamson & Co., Ltd.	£19,833	About 12 months.
W. H. Allen, Son & Co., Ltd. ..	£17,750	9 mths., subject to condition.
Belliss & Morcom, Ltd.	£18,250	10 working calendar months.
Cole, Marchant & Morley	£16,750	40 weeks without guarantee.
English Electric Co., Ltd.	£19,000	About 10 mths. after termination of moulders' strike.
Hick, Hargreaves & Co., Ltd. ..	£17,965	10 months.
Metrop.-Vickers Elec. Co., Ltd. ..	£18,410	11 mths., subject to conditions.
Mirrlees Watson Co., Ltd... ..	£17,286	10 months.
C. A. Parsons & Co.	£18,700	12 months and two weeks.
Richardsons, Westgarth & Co. Ltd.	£17,794	Ex. works 9 months.
Worthington-Simpson, Ltd. ..	£16,782	9 months.

Leyton.—Urban District Council:—
E.H.T. main cables.—W. T. Henley's Telegraph Works Co., Ltd., £6,151.

London.—POLICE LANTERNS.—Messrs. Greenwood and Batley, Ltd., have recently received the sole contract for the supply of their "Bipol" accumulators for use in the new electric lanterns with which the Metropolitan Police are being supplied.

Salford.—Tramways Committee. Accepted:—
One double-deck motor-omnibus, and one type "G." chassis, £1,980 less 10%.—Leyland Motor Co.
70 weldless steel poles, £2,676.—British Mannesman Tube Co., Ltd.
Electricity Committee. Accepted:—
Additional switchgear at the Trafford sub-station.—Bertram Thomas.
5,000-KW. turbo-alternator set, complete.—Metropolitan-Vickers Electrical Co., Ltd.
1,500-KW. rotary-converter set.—Metropolitan-Vickers Electrical Co., Ltd.

Stafford.—County Education Committee:—
Wiring of electrical laboratory at the Engineering School.—J. Richards and Co., £88.

Tasmania.—Government Hydro-electric Department. The following contracts have recently been placed for new plant and equipment:—
Three 8,000-H.P. turbines.—Boving & Co.
Three 7,050-K.V.A. generators.—Australian General Electric Co.
15 2,333-K.V.A. transformers.—Metropolitan Vickers Electrical Co.
300-amp.-hour battery.—Tudor Accumulator Co.
—Tenders.

LAUNCESTON.—Town Council. Accepted:—
43 electric motors and starters, £1,949.—G. Weymouth Pty. Meters for ditto, £98.—Australian General Electric Co.
Switchgear, £303.—W. McLean & Co.
—Tenders.

Tipperary.—Board of Guardians:—
Electrical plant at the workhouse.—Ferguson & Benty, £970.

FORTHCOMING EVENTS.

Chief Technical Assistants' Association.—Saturday, February 7th. At Anderton's Hotel, Fleet Street, E.C. At 3 p.m. Discussion on "The Design and Equipment of Sub-stations," to be opened by Messrs. Bowden and Ingram.

Society of Engineers.—Monday, February 9th. At Burlington House, Piccadilly, W. At 5.30 p.m. Presidential address by Mr. B. Geen. Presentation of premiums awarded in 1919.

Association of Engineers-in-Charge.—Wednesday, February 11th. At St. Bride's Institute, E.C. At 7.30 p.m. Paper on "Coal Saving by Scientific Control in the Boiler House," by Mr. D. Brownlie.

Saturday, February 14th. At St. Bride's Institute. At 7.30 p.m. Social and Dance.

Edinburgh Electrical Society.—Wednesday, February 11th. At the Philosophical Institute. At 8 p.m. Lecture on "The History and Development X-Ray Apparatus," by Mr. Law.

Institution of Electrical Engineers.—Thursday, February 12th. At the Institution of Civil Engineers, Great George Street, S.W. At 6 p.m. Paper on "The Protection of Alternating Current Distribution Systems Without the Use of Special Conductors," by Major K. Edgcumbe, R.E.

(**North-Eastern Centre**).—Monday, February 9th. At the Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "Transformers for Electric Furnaces," by Mr. J. L. Thompson.

(**North Midland Centre.**)—Tuesday, February 10th. At the Royal Victoria Hotel, Sheffield. At 7 p.m. Lecture on "The Rotherham Power Station," by Mr. E. Cross.

(**North-Western Centre**).—Tuesday, February 10th. At the Engineers Club, Manchester. At 7 p.m. Lecture on "A Critical Survey of Power Supply in the Rhine Valley," by Lieut.-Colonel F. C. Aldous and Mr. A. E. Leigh Scanes.

(**Scottish Centre**).—Tuesday, February 10th. At 207, Bath Street, Glasgow. At 7.30 p.m. Paper on "Transformers for Electric Furnaces," by Mr. J. L. Thompson.

(**South-Midland Centre.**)—Wednesday, February 11th. At the University, Birmingham. At 7 p.m. Informal discussion on B.E.S.A. Specification No. 72.

(**Students' Section**).—Friday, February 13th. At the Royal Technical College, Glasgow. At 7.30 p.m. Paper on "The Electrical Equipment of Cranes," by Mr. G. W. Turner.

Association of Engineering and Shipbuilding Draughtsmen.—Lectures will be given at Chesterfield and Liverpool on February 12th.

Royal Institution of Great Britain.—Thursday, February 12th. At 3 p.m. At Albemarle Street, W. 1. Lecture on "Recent Progress in Applied Optics," by Prof. A. E. Conrady (Lecture II).

Saturday, February 7th. At 3 p.m. Lecture on "The Astronomical Evidence Bearing on Einstein's Theory of Gravitation," by Sir F. W. Dyson.

Liverpool Engineering Society.—Thursday, February 12th. At the Exchange Station Hotel. At 7.30 p.m. Annual dinner.

Salford Technical and Engineering Association.—Saturday, February 14th. At the Royal Technical Institute. At 7 p.m. Paper on "Liquid Air," by Mr. J. L. Duckworth.

"Daily Mail" Ideal Home Exhibition at Olympia.—Open to February 25th.

Electro-Harmonic Society.—Friday, February 13th. At the Holborn Restaurant (Venetian Chamber). At 8 p.m. Concert. (Ladies' night.)

NOTES.

Notice to Readers.—It appears that some of our readers are experiencing difficulty in securing their copies of the ELECTRICAL REVIEW regularly and promptly through the ordinary distribution channels, owing to transportation and other matters. We would, therefore, again urge the wisdom of their becoming subscribers, either yearly or half-yearly.

Subscription orders should be sent direct to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C.

We give on advertisement page No. 28 to-day an order form for the convenience of intending subscribers.

Telegraph Wire Destruction.—At Fermoy, Co. Cork, Quarter Sessions, before the Recorder of Cork, last week, the Postmaster-General applied for £70 compensation for the malicious cutting and destruction of a large number of telegraph and telephone wires on the public road between Cork and Midleton, and Queenstown, on the night of January 3rd, on which occasion an attack was made on the police barracks at Carrigtwohill. The wires were all repaired at a cost of £47, and the Recorder granted compensation for this amount.

Electric Starters for Marine Motors.—At the Scottish Motor Show some large size C.A.V. electric starters were exhibited, which have been used, it is stated, on marine engines up to 200 H.P.

A New Federation.—As the result of a preliminary conference of members of professional and supervisory associations which was held on November 22nd, a meeting is to be held to-morrow (February 7th), at the Essex Hall, Strand, London, of representatives of such societies with a view to inaugurating a "National Federation of Professional, Technical, and Supervisory Workers," for the purpose of safeguarding the interests of the members of the affiliated associations, and of promoting friendly relations between them and the industrial workers' organisations. Some 40 societies have been invited to send delegates to the conference, including the Association of Engineering and Shipbuilding Draughtsmen, the Society of Technical Engineers, the Electrical Power Engineers' Association, the National Association of Supervising Electricians, the Electricity Supply Commercial Staffs' Association, and the National Union of Scientific Workers.

Australian Engineers.—The Victorian section of the Electrical Association recently merged itself into the newly-formed Institution of Engineers of Australia.

Educational.—UNIVERSITY OF LONDON.—At a recent meeting of the Senate several gifts were acknowledged, and thanks accorded to the donors. A sum of £50,000 was given by the General Committee to promote the institution of degrees in commerce, and the organisation of commercial education in the City of London and throughout the Empire, to be devoted to extensions of the School of Economics.

Messrs. S. B. and J. B. Joel presented £20,000 to provide a University Chair of Physics at the Middlesex Hospital Medical School. This will bear the name of the donors.

An offer of £150 a year for three years from the Rhodes Trustees, in aid of the work of the Professor of Constitutional Law at University College, was gratefully accepted.

CORRESPONDENCE TUITION.—We have received from University Engineering College, London, a copy of Prospectus No. 8, giving particulars of the "U.E.C." system of technical training by correspondence, and details of the standard courses which have been organised. These include all branches of electrical engineering, elementary and advanced, as well as mathematics and physics, civil and mechanical engineering, and special courses leading to the London University B.Sc. degree, and the examinations of the engineering Institutions, the City and Guilds of London Institute, the Board of Education, and Government service.

The Education Department of the Metropolitan-Vickers Electrical Co., Ltd., has just published a circular giving a list of lectures for its staff and workpeople. The lectures deal with economics, engineering, &c., and should prove of great value.

FARADAY HOUSE ELECTRICAL ENGINEERING COLLEGE.—The annual examinations for a Faraday Scholarship of 50 guineas per annum, tenable for two years in college and one year in manufacturing works, and for a Maxwell Scholarship of 50 guineas per annum, tenable for one year in college and one year in works, will be held at Faraday House on April 13th, 14th and 15th. Particulars can be obtained from the Secretary, Faraday House, Southampton Row, London, W.C. 1.

British Oil.—The report of the Petroleum Executive on the last year's progress contains interesting particulars of new borings. In Derbyshire, the Hardstoft bore gave more satisfactory results than the first observations seemed to indicate. By keeping the oil level at a depth of 1,000 ft., a daily yield of 20 barrels (700 gallons) was obtained, and at a level 3,000 ft. below the surface the supply was 35 barrels (1,225 gallons) a day.

Summer-Time on the Rhine.—By order of the Inter-Allied Rhineland High Commission, summer time in the German occupied territory came into effect at midnight, January 31st—February 1st.

Appointments Vacant.—Assistant lecturer and demonstrator on electrical engineering (£300), for the Sheffield University Faculty of Engineering; cable jointer, for the Todmorden Corporation Electricity Works; laboratory steward (42s. + 20 per cent. + 23s.), for the Paddington Technical Institute; meter fixer and tester (73s.), for the Colne B.C. Electricity Works; telegraph inspectors (£200 + £65), for the Posts and Telegraphs Department, German East Africa; shift engineer (79s. 6d.), for the City of Peterborough Electricity Department; mains superintendent (£300), for the South Shields Corporation Electricity Works; fitter driver, for the Shoreditch Borough Council Electricity Supply Department; shift engineer (£234) for the Doncaster Corporation Electricity Department; mains engineer (£390) for the Walsall Borough Council Electricity Supply Department. See our advertisement pages to-day.

Pulverised Coal.—The central power station of the Puget Sound Traction, Light, and Power Co., at Seattle, U.S.A., has been converted from fuel oil to pulverised coal, using the waste from a local mine of lignite coal, the coal having a calorific value of 9,000 B.TH.U. and the culm a value of 7,300 B.TH.U., with 25 per cent. moisture, 28 per cent. volatile matter, 26 per cent. fixed carbon, and 20 per cent. ash. Bottom dump wagons operated by an electric locomotive deliver the culm to a bin, from which it is fed to a conveyor belt feeding a single-roll crusher, which is driven by a motor and reduces the material to ¼-in. size, this product being conveyed by an elevating conveyor to a bin. Two conveyors feed the crushed coal to a pair of driers of the Fuller indirect-fired rotary type, fitted with baffles, and having an induced draught created by a fan. Each drier can handle 7 to 10 tons per hour, reducing the moisture to 2·25 per cent., with the outgoing material at a temperature of about 240°. In passing from the driers, the coal slides down chutes, where magnetic separators remove any iron scrap, &c. The dry coal goes to a bin, from which it is fed to a set of Fuller fan pulverisers and a Raymond impact pulveriser. The pulverised coal is delivered to bins over the boilers, and flows by gravity to screw feeders, which convey it to the burners, which discharge it into a combustion chamber 14½ ft. × 8½ ft. and 5 ft. high. There are 10 boilers of 300 H.P. to 600 H.P., the smaller ones being fitted with superheaters. The ash ranges from dust to soft and hard clinker, the latter being crushed and all delivered by a conveyor to an ash-bin.—*Engineer.*

Accident.—At Ashton-under-Lyne, on January 30th, Lance-Corporal Thomas Bent was crossing Whitesere Road, when he came in contact with a "live" electric tramway wire, which was lying in the road. He was thrown to the ground and rendered unconscious. He was taken to the District Infirmary, but did not regain consciousness for several hours.

The Metric System.—Continuing its energetic propaganda for the metric system, the World Trade Club of San Francisco is sending a large number of letters to British addresses, enclosing postcard petitions addressed to the Board of Trade and to President Wilson.

The Secretary of the Decimal Association has undertaken the counting and classification of the petitions received by the Board of Trade, and the Association hopes that all who receive these letters from the World Trade Club will sign and forward the petitions.

The Telegramaphone.—According to the *Daily Mail*, Major Lionel Guest and Capt. H. O. Merriman have succeeded in producing a device whereby it is possible to dictate a message into a telephone receiver at one end of a wire, and at the other end an automatic recorder inscribes the message on a gramaphone record for later reproduction. The blurring or metallic tone effect is said to be practically eliminated.

Engineering Research in France.—The metallurgical and engineering firms in the Grenoble district are showing a commendable exhibition of independent initiative. Without waiting for a Government vote of credit, more or less problematical, they have gathered together the funds to found a mechanical and metallurgical research laboratory. The laboratory itself is secured, and they have appointed a competent local man as its head. There only remains the acquisition of the needful machinery equipment. This is to be attained partly by purchase and partly by gifts, which have been invited.

Fatalities.—In an attempt to help his mate, who had become entangled with "live" wires, brought down by the storm at Wakefield on Thursday morning last week, near the Kirkgate L. & Y. station, William Riley, railway goods guard, of Wakefield, was killed. His mate, Sam Parks, and he were approaching Kirkgate about 3 a.m., from a passage, when Parks became entangled in telephone wires which were highly charged. Riley, who went to help his mate without regard to his own danger, was himself caught. The telephone wires crossing the street had been broken by the snow, and had fallen across the live overhead wires of the tramway in Kirkgate. A Corporation sub-station attendant, named John Hawkins, came and cut and cleared the wires, but Riley was found to be dead. Parks had been able to get clear by crawling out, and he escaped with burns on the leg and hands. The dead man was 30 years of age. A similar fatality occurred at Huddersfield, where J. Spivey (62) stepped amongst broken wires which had come in contact with an electric street lamp.

Gloucestershire Joint Electricity Authority.—In our report of the proceedings at the meeting of electricity supply authorities at Bristol, in our issue of January 9th, the names of the members of the Committee appointed to draft a scheme were given; to these should have been added that of Mr. J. Herbert Edwards, a director of Stroud Electric Supply Co., Ltd., who represented the company undertakings on the Drafting Committee.

Agricultural Research.—A research department has been established by the Olympia Agricultural Co., Ltd., which is farming no less than 20,000 acres; the director of the department is Dr. Charles Crowther, late Professor of Agriculture in the University of Leeds. It is to be hoped that the various applications of electricity to agriculture will find place amongst the subjects investigated.

Refrigeration.—At a conference held in Paris recently an International Institute of Refrigeration was formed, under the directorship of M. Emile Gouault, the Secretary-General of the French Association of Refrigeration. Seven Special Committees were appointed to deal with various aspects of the Institute's activities—scientific questions, refrigerating materials, general application of refrigeration, transport, instruction and propagation and general economics and statistics. An international convention was drawn up at the conference, copies of which are to be submitted for ratification to all Governments interested in the proposals.

Electric Police Lamps.—The familiar bull's-eye oil lamps used by the London police are to be replaced by electric lanterns. The distribution commenced on January 29th, and will continue daily till the entire force of 20,000 is equipped with them. The lanterns are compact, with two flat sides and a hook for the belt. The accumulators are recharged every day.

The Electrical Treatment of Sewage.—The following is an abstract of a paper on the Landreth direct-oxidation process of electrical treatment of sewage contributed to the *Journal* of the Franklin Institute by Messrs. H. J. M. Creighton and B. Franklin.

In the Landreth direct oxidation process for the treatment of sewage, both electricity and lime are employed. The efficacy of the process depends upon the combination of these agents, neither electricity nor lime alone producing such good results. The electric current liberates at the electrodes oxygen and hydrogen which in the nascent state are claimed to promote the destruction of pathogenic bacteria, and a reduction of the nitrogenous organic matter to albuminoids, peptones, and amino compounds, which are subsequently oxidised to nitrites, nitrates, and carbon dioxide. The presence of lime furnishes not only an alkaline medium which lowers the electrical resistance of the sewage and renders the electrodes passive, thus very greatly decreasing the quantity of iron which passes into solution from the anode, but it also aids in sedimentation. The process differs from others that employ electricity, in that purification is effected neither by the action of dissolved iron as a coagulant, nor primarily by the disinfecting action of nascent chlorine produced by electrolysis.

In the spring of 1918 a million-gallon plant was erected at Easton, Penna., by Mr. Landreth, for demonstrational purposes. Its location in the heart of the residential district and the entire absence of complaints and unfavourable comments indicate that the plant is not considered a nuisance, and that the nearby residents are not annoyed by odours or other objectionable features.

The cost of operating a two-million gallon per day plant is about $31.97, or 58 cents *per capita* per year (20,000 population), of which about 51 per cent. is for labour alone. The number of units can, however, be largely increased without any appreciable increase in the amount of labour necessary to operate the enlarged plant. The *per capita* cost of construction of a direct oxidation plant compares favourably with that of any other process, and the economy resulting from the use of this process is effected largely through a saving in the cost of construction.

Electric Vehicle Progress.—The Bradford Corporation has invited tenders for the supply and delivery of two electric battery locomotives, 60 c.m. gauge, with a haulage capacity of about 10 tons on the level. Six electric vehicles are to be obtained by the Ilford Urban Council for refuse collection purposes. The cost is placed at £1,325 for each vehicle. The County of London Electric Supply Co., Ltd., has placed an order with the General Vehicle Co. for two electric vehicles—a 3½-tonner and a 2-tonner—for coal cartage purposes. The vehicles will be fitted with Craymer unloading gear. Six "G.V." electrics, each of 3½ tons capacity, have been ordered by Whitbread's Breweries, London. The whole of these vehicles will be equipped with Ironclad-Exide batteries. The Electricity Committee of the Manchester Corporation has invited tenders for the supply and delivery of a 2-ton electric lorry and a 10-15 cwt. electric vehicle of the van type. Two "G.V." electrics, each of 2-ton capacity, have been ordered by the Nottingham Corporation Cleansing Department for early delivery. An electric vehicle is to be purchased for use by the Wolverhampton Cleansing Department. The Watford Urban council is considering a proposal for the introduction of a fleet of electric vehicles for refuse collection. Estimates prepared by the surveyor for the provision of a garage, necessary machinery, and electric vehicles are as follows: Four 3½-ton electric vehicles, with bodies, at £1,485 (£5,940); one interchangeable body, £260; one motor generator, £500, switchgear, £200, erection, £100 (£800); garage and generator house, £4,000. The committee anticipates that each electric vehicle will do the work of no fewer than three horses. The recommendation of the committee was that application be made to the Ministry of Health for sanction to a loan not exceeding £11,000, to cover the estimated expenditure.—*Electric Vehicle.*

Electrical Signalling on Railways.—In *La Technique Moderne* for November, 1919, the methods of repeating mechanical signals on locomotives which have been tried in France are reviewed, and a new system of wireless communication, designed to obviate the troubles inherent to mechanical contact devices, is described. This system has been developed by M. Augereau, and is to be installed on the State railways. Alongside of the mechanical signal a simple wireless set similar to that used by the army in the war is fixed; it consists of a small induction coil giving a 3-cm. spark with an 8-volt battery, a spark gap, and an antenna consisting of a copper wire 15 m. long, supported horizontally parallel to the track at a height of 1.5 m. One pole of the battery is earthed; the other is connected to an insulated rail by way of the primary of the coil, and a switch connected with the signal closes this circuit when the signal is put at "danger." No current passes, however, until the insulated rail is earthed by the passage of a train over it, when the coil is energised and hertzian waves are emitted. As the passage of a long train would operate the apparatus for an unnecessarily long time, two "economy treadles" are inserted in the primary circuit at a suitable distance apart, and are provided with dash-pots which delay their action, so that the signal is only given, and the battery is only in operation whilst the leading wheel is passing from one treadle to the next. On the locomotive a local battery, an electromagnet, and a coherer are connected in series, and a copper antenna is connected to the coherer, the other pole of which is earthed. As the antennæ are close together when the locomotive is passing the signal, the coherer is excited by the electric waves and permits the battery current to flow through it, actuating the electromagnet, and thereby tripping mechanism which sets a steam whistle in operation. A rather complicated locking apparatus is associated with the system, for the purpose of registering on the speed-recorder the operation of the signal, and its cancellation by the driver; it will be observed that the system only functions when a locomotive *runs past* a signal which is at "danger."

Many accidents have taken place on the French railways through failure to observe the mechanical signals, and the Ministry of Public Works has therefore decided to install the Augereau system on all the State railways and locomotives as soon as possible.

Load Dispatching in Central-station Systems.—A description is given in the *Electrical World* of the system operator's department in the Philadelphia Electric Co.'s system. The principle of controlling the equipment under the orders of a load dispatcher was inaugurated ten years ago, when there were only two generating stations and a dozen sub-stations in the system. There are now ten generating stations, 28 regulator sub-stations, and 45 industrial sub-stations. An automatic record chart is provided in three large panels, containing in symbolic form every single apparatus with which the operator is concerned. There are about 800 signal lights on this board, denoting the various pieces of apparatus in service. These lamps are operated from a key-board in the load-dispatcher telephone exchange, and provide an extra representation of the whole system at every moment. In addition to complete telephone communication, a telautograph system is provided, and the whole equipment is considered to be a good model to follow in organising a load dispatching system for a complex network. The network controlled by the Philadelphia system covers an area of 245 square miles, and includes a generator capacity of 240,000 K.V.A. The load dispatcher's responsibility extends from the boilers to the distribution circuits, and includes the generation, transmission, and distribution of the proper amounts of energy. The dispatcher computes the demand to be met, schedules it on to the various stations, ascertains that each station has sufficient steam and electrical capacity to carry the proposed load, and that there is sufficient reserve equipment in each station. In order to do this, he maintains records showing the load required by each sub-station and distribution circuit. No switching is done without his instruction, except the standardised operations provided for emergencies. No set is started or stopped, and no apparatus is worked upon without a permit from the dispatcher, who is also responsible for all blocking and for the testing of new and repaired equipment.

Electrified Seed.—The January number of the *Journal* of the Ministry of Agriculture contains, among other interesting features, a report by Mr. E. J. Russell, Director of the Rothamsted Experimental Station, relating to the electrolytic treatment of seeds (Wolfryn process), described in our pages on several occasions last year. The writer states that during the past three seasons there has been offered to farmers seed treated by this process which, it is claimed, causes marked increase in yield. The cost of the treatment in the case of wheat seed is about 28s. per quarter, which works out at about 7s. to 10s. 6d. per acre. Mr. Russell, after examining the results of experimental tests, concludes that the failure of electrified seed to give any increase in yield under the carefully controlled conditions of an experimental station trial, shows that the process lacks certainty. "It cannot be compared in effectiveness with manuring, which succeeds nearly every time if properly done." The risk of failure seems so great, he adds, that the farmer should look upon it as an adventure which may or may not prove profitable.—*Morning Post.*

INSTITUTION NOTES.

Institution of Electrical Engineers.—The annual dinner of the North-Eastern Centre was held in Newcastle-on-Tyne on January 30th, under the presidency of Mr. W. Cross, the local chairman, who was supported by the Lord Mayor of Newcastle (Mr. Walter Lee) and Mr. Roger T. Smith, President of the Institution. The loyal and patriotic toasts were honoured, the chairman remarking upon the many applications of electricity made during the war. Mr. A. P. Pyne then gave the health of the President and the Council of the Institution, who devoted a large part of their energies to looking after the interests of electrical engineering, and particularly those of the 8,200 members. The President, in replying, said that during the war the idea of service gripped the individual of almost every class, but now, probably through re-action, the idea of service seemed to have departed altogether from the ideas of the wage-earner. The wage-earner had demanded a shorter day, and very rightly, but in order that he might enjoy that shorter day, professional men and members of the middle classes had had to work longer hours without any extra pay. The intellectual Socialists had always claimed that service for the State was the ideal, and even some of the members of the Miners' Union had stated that if the mines were all nationalised the miners' hearts and ideas would be changed by some miracle, and they would at once give willing and full service and increase the output of coal. That, he thought, had to be taken with a grain of salt, and it seemed to be left to the professional and middle classes, and to those to whom service for their country was a sort of family tradition, to refute the doctrine that organised selfishness was the only way in which they could continue their social and industrial life. He believed that service and sacrifice were alone worthy of the highest condition of a civilised state. Speaking of the work of the Institution, he said their greatest asset was the Territorial Centres, and the increase, or decrease, of the value of that asset depended very largely upon the Centres themselves. Its value would be best increased if the members of the Territorial Centres would keep before them the ideal of service for the Institution and the industry which the Institution represented.

Mr. H. W. Clothier proposed the toast of "The City of Newcastle." He said that the huge electrical developments emanating from the men of Newcastle were maintaining the city's name for originality and greatness. In that district they had an electric power system covering 1,000 sq. miles, with a huge mesh-work of copper connections, and the system was becoming a model not only for England but for the whole world.

The Lord Mayor responded, and alluded to the part played by the members of the electrical profession in the war.

The health of "The Guests" was submitted by Mr. J. R. Beard, to which Mr. H. Shaw and Mr. Ll. B. Atkinson responded.

Liverpool Sub-centre. — As reported in our issue of January 30th, this Sub-centre was opened on January 19th, when Prof. Marchant, D.Sc., delivered his inaugural address. The Vice-Chancellor of the University (Dr. Adami) heartily welcomed the members, and said that electrical power and transmission was a question of great importance to the University. Mr. Roger T. Smith, President I.E.E., referred to the activity of the Institution, indicated by the way in which branches had sprung up in so many parts of the country. He reminded his audience that the future of the Institution was, to a great extent, in the hands of these Centres and Sub-centres, and he hoped that the members would feel that it was their duty to support the Council and President in every way possible. Mr. Smith said that Prof. Marchant was a very valuable member of the Council, and the members were to be congratulated upon securing him as chairman. Mr. C. H. Wordingham, C.B.E., said that the primary reason for the formation of sub-centres was that it was as impossible for many members to attend Territorial Centres as to meet in London. It was undesirable to form new *centres* for these districts—first, on account of the comparatively small number of members, and also because, under the constitution of the I.E.E., the chairmen and past chairmen of Centres were entitled to seats on the Council, and, therefore, if there were too many centres, the elected members of the Council would be entirely outnumbered. He recommended specialisation in wireless telegraphy and the equipment of ships, as being the most important branches of electrical work for Liverpool. Dr. Marchant then read his address, of which an abstract appeared in our last issue. Mr. Dickinson proposed a vote of thanks to the chairman, which was seconded by Mr. G. H. Nisbett. Prof. Marchant, in his response, said that thanks were due to the Vice-Chancellor and Messrs. Roger T. Smith and C. H. Wordingham for attending and addressing the meeting. He regretted that Mr. J. H. Robertson, the chairman of the North-Western Centre, was forced to be absent on account of a prior engagement.

Informal Meeting.—On Monday evening last there was a full attendance to hear Major T. Rich's paper on "Engineering Experiences During the War." The author dealt largely with the administrative system which was in force on the Western Front, and levelled a telling indictment against the methods adopted in connection with the Engineering Department, which only too often resulted in the appointment of officials who were wholly ignorant of their functions, the employment of apparatus utterly unsuited to its purpose, and an appalling amount of inefficiency and wanton waste of money. The enemy, on the other hand, not only employed competent engineers, but also gave them adequate authority to carry their plans into execution, with the result that the resources of engineering were utilised to the full against us; the French also attained a high standard of efficiency in their engineering work. Major Rich made it clear that his criticisms were directed not against the *personnel* of the Royal Engineers, but against the effete system of training and administration which made such things possible, and which unquestionably greatly prolonged the war, besides adding to the cost enormously. He also gave an account of the electrical engineering methods and apparatus that were employed in the field. An interesting discussion followed, in which many members who had been actively engaged in engineering operations in the various fields of war took part.

Western Centre.—At the meeting at Cardiff on Monday evening last, the chairman (Mr. Arthur Ellis) presided over an excellent attendance, and stated that the suggestion of holding a summer meeting of the Institution in the area covered by the Western Centre had received a most gratifying reception at headquarters, and the details for arrangements had been relegated to a Sub-Committee. The date provisionally selected was Monday, July 12th, and the proceedings would last until the following Friday. Members were urged to use every endeavour to ensure the success of the meeting. In consequence of continued pressure of business, one of the joint hon. secretaries (Mr. A. J. Newman) had found it necessary to resign the duties appertaining to that office, and Mr. A. J. Ostler (Bristol Corporation Electricity Department) had accepted the vacant post. After the transaction of routine business, the paper of Messrs. A. G. Ellis and J. L. Thompson on "Large Power Transformers" was read by Mr. A. G. Ellis, and discussed. Prior to their departure for Bristol, the members and visitors from that city enjoyed the hospitality of the chairman.

East Midland Sub-Centre.—A sub-centre has been formed, with headquarters at Loughborough, and Mr. F. S. Grogan, M.I.E.E., has been invited to act as chairman. Meetings will be held at Loughborough, Derby, Nottingham, and Leicester. The inaugural meeting took place on February 3rd, at the Technical College, Loughborough.

Association of Mining Electrical Engineers.—At a meeting of the Birmingham Branch on January 24th, Captain Douglas Wilson read a paper on "The Semi-Diesel Crude Oil Engine." The speaker pointed out the incorrectness of the name applied to the engine, and said it was preferable to describe it as a surface ignition engine, having as an essential feature an uncooled portion of the combustion chamber normally at high pressure, which augmented the heat generated by compression. Mr. E. P. Hollis, who presided, spoke upon "The Advantages of the Oil Drive."

Edinburgh Electrical Society.—On January 28th a paper on the "New Regulations for Electrical Ship Equipment" was read by Mr. D. S. Munro, M.I.E.E., and discussed by the members present. In view of the inability of Mr. Plucknett to have special petrol-gas plant forward for demonstration in time for the next meeting, his paper has been postponed. Mr. Law, of the Royal Infirmary, has volunteered to deliver a lecture on Wednesday, February 11th, the subject being "The History and Development of X-Ray Apparatus." The lecture will be of special interest, and is to be illustrated by lantern slides. It will be held at the Philosophical Institute at 8 o'clock.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. E. W. SELLS, manager for Oswald Jones & Co., electrical and power engineers, of Maidstone, has returned from service in Mesopotamia and rejoined the business.

Colonel H. C. SPARKS, C.M.G., D.S.O., M.C., M.I.E.E., M.I.Mech.E., has been appointed a governor of Faraday House Engineering College, where he was a student from 1891-1892.

Friends of Mr. J. WILKINSON, M.I.E.E., M.I.Mech.E. (who recently resigned his position of tramways electrical engineer to the City of Hull Corporation), will be sorry to learn that he is at present undergoing a serious operation at the Royal Infirmary, Hull.

Mr. J. H. CASTELL has resigned his position with the British Thomson-Houston Co., Ltd., after 15 years' service at Rugby and Willesden. Upon leaving he was presented with a gold watch by his colleagues. Mr. Castell is taking up steelwork and foundry agency work at Clun House, Surrey Street, Strand, W.C., and will represent, amongst others, Messrs. S. Wheeler & Co., constructional engineers, Smethwick.

Mr. E. KILBURN SCOTT, who has been in New York for the past two years, was in Canada last month on a visit, and on January 6th he was to deliver an address at a meeting of the Canadian Club at Owen Sound, Ont.

Over 200 applications have been received for the post of an engineer to supervise the mechanical and electrical engineering work at Edinburgh, particularly in connection with the baths and wash-houses. A sub-committee of the town council is to draw up a short list.

Mr. F. WALTON, of Bradford, has been appointed chief constructional engineering assistant to the Southend-on-Sea Corporation Electricity Works, at £400 per annum.

Mr. Y. SAVILLE has been appointed assistant manager of the Plymouth tramways undertaking.

Burnley Town Council has decided to increase the salary of Mr. H. MOZLEY, tramways manager, from £500 plus £75 war bonus per annum, to £675 per annum including bonus.

Burnley Electricity Committee has recommended the following increases: Mr. J. E. STARKIE, chief engineer, from £674, including £73 bonus to £800 per annum; Mr. T. B. NUTTER, chief assistant, from £330, including £80 bonus, to £360 per annum.

The salary of the tramways manager at Haslingden has been increased to £350 per annum.

Commander J. R. SCHOFIELD, principal of the Swansea Wireless Training College, has been presented by ex-service students of the college with a barometer.

Newport (Mon.) Electricity and Tramways Committee has recommended that the salaries of Mr. A. N. MOORE, electrical engineer, and Mr. N. J. YOUNG, tramways manager, be increased, as from January 1st last, to £800; from April 1st to £850, and from January 1st, 1921, to £900.

Mr. S. G. POOLE, shift engineer at the Peterborough Corporation electricity works, has been promoted to the position of second assistant engineer.

For the post of assistant engineer to the Willesden District Council electricity department, 130 applications were received. Three were selected to appear before the Electricity Committee, and Mr. I. D. SPARKS was appointed.

Mr. FRANK H. GALE informs us that owing to ill-health he has resigned his position with Messrs. Isaacson & Brown, Ltd., with whom he has been for fourteen years.

The St. Helens Town Council is recommended to increase the salary of Mr. B. T. HAWKINS, the Corporation electrical engineer, from £500 to £600 per annum.

Obituary.—MR. J. W. PENFOLD.—The death occurred on January 28th of Mr. James William Penfold, who was chairman of Messrs. Page & Miles, Ltd., electricians, of Brighton. He served on the Town Council for over 15 years.

MR. W. J. KEMBER.—We regret to learn that Mr. William James Kember, of The Nest, Finwood Hill, Warwickshire, died of pneumonia on January 27th, aged 67 years. He was well known to manufacturers in the metal trades throughout the country as a representative of Messrs. W. Canning and Co., of Birmingham, having been in their service over 26 years until his retirement in 1918.

THE PROGRESS OF AUTOMATIC SUB-STATIONS IN U.S.A.*

THE first automatic sub-station control was put into operation on Christmas Eve, 1914, in the Union sub-station of the Elgin and Belvidere Electric Railway, and in the following August the two remaining sub-stations of this road were equipped. The success of the venture immediately attracted the attention of railway engineers, so that several automatic-control equipments and complete sub-stations were purchased and installed in 1916. It is of interest to note that the second railway company to install an automatic railway substation decided to operate a semi-outdoor station, provision being made for housing only a 500-KW. rotary converter, the switchboard and the drum controller. At this time two other systems decided to install a total of 12 automatic equipments. One of these early installations was the first portable automatic sub-station. In 1917 the first installation involving the operation of two synchronous converters in series was made, and in 1918 two synchronous converters were first automatically operated in parallel. Two more portable automatic sub-stations were put into service in this year. Four and one-half years after the first experiment was made there were 35 full-automatic and two semi-automatic, or remote-controlled sub-stations in actual operation, and an additional 31 automatic and four semi-automatic equipments stood on order with manufacturers. These 72 equipments control several types of synchronous converters and motor-generator sets of capacities varying from 200 to 2,000 kilowatts.

On May 1st a number of control equipments sufficient to control 37,500 KW. of rated machine capacity had been purchased. Thus far the tendency has been to apply automatic control more generally to machines having rated capacities of 500 KW. and under, the total number of machines coming within this range being 58. This number includes twenty 300-KW. and twenty-eight 500-KW. units. A good start is, however, being made on machines of larger capacity, as one 1,000-KW. synchronous converter is now operating automatically and six 1,000-KW. synchronous converters, one 1,000-KW. motor-generator set, two 1,500-KW. synchronous converters, and one 2,000-KW. motor-generator sets are on order, and will probably be put in service before the close of 1919.

While 44 stations are to receive 25-cycle energy, a total of 18 stations are to receive 60-cycle energy, and eight stations will operate at odd frequencies, including 30, 35, 40, and 50 cycles. The high-tension line voltage varies from 2,200 to 66,000. The trolley voltage supplied is generally standard at 600 volts direct current, excepting one 1,200-volt direct-current system and one 1,500-volt direct-current system.

While the largest synchronous converter yet to be automatically controlled is a 1,500-KW. machine, and the largest motor-generator set a 2,000-KW. machine, there is at the present time in operation a 3,000-K.V.A. synchronous condenser. The first automatically controlled waterwheel generating station, which contains three 500-KW. generators arranged to operate in parallel either under the influence of full-automatic control at the generating plant or controlled if desired by an operator in the main steam-generating station at a distant point, was put in operation in 1918. The success of this installation without question makes possible the development of a considerable number of small water powers that otherwise could not be developed because of the cost of operating labour.

Several companies have chosen automatic equipment in consideration of the saving possible from the elimination of light load losses, as well as from a consideration of saving in labour. The largest figures received gave an estimated saving of $400 per annum on a 300-KW. station, and $700 on a 500-KW. station. One company installed a 250-KW. automatic station to replace a floating battery between two sub-stations ten miles apart, in preference to spending $5,000 for necessary repairs to the battery. When some of the automatic sub-stations were built in new locations, however, it was in several cases possible to remove feeder copper which possessed a value sufficient to offset in part the cost of construction of the sub-station building with its equipment. In an exceptional case the cost of construction of a two-unit sub-station containing two 300-KW. synchronous converters was more than offset by the value of the feeder copper that was removed from the distribution system, and a more satisfactory line voltage was maintained on the line as a whole. The most notable saving in copper was made in Des Moines, where, through the installation of a system of automatic sub-stations, an amount of feeder copper was taken down which, at 20 cents per pound, was worth $90,200, and at the same time a sub-station and distribution system were obtained which cost according to estimate $141,700 less than an equivalent system to give the same voltage regulation would have cost, had additional manually operated synchronous converters been placed in the central power station and additional feeder copper put up on the outside lines. As an example of another exceptional case, it has been estimated that one important interurban line in central New York

*Abstract in *Power* from the report of the Committee on Power Generation presented at the convention of the American Electric Railway Engineering Association, at Atlantic City, N.J., October, 1919.

State, "because of its surplus feeder capacity can, by adopting automatic sub-stations and removing part of this copper, make an annual saving of $24,000 with approximately zero investment." These examples are unusual, but are given to illustrate the possibilities that are offered in not a small number of cases.

It was brought out in the discussion on this report that at the present time the economic limit in automatic sub-station capacity is about 6,000 KW.; above 6,000 KW. it is more economical to install manually operated equipment.

NEW COMPANIES REGISTERED.

W. B. & J. Bain, Ltd. (10,912).—Private company. Registered in Edinburgh January 21st. Capital, £7,000 in £1 shares. To acquire the business of general and electrical engineers and merchants, agents for manufacturing engineers, carried on by W. B. Bain and J. Bain, at 52, Robertson Street, Glasgow, as W. B. & J. Bain. The subscribers and directors (each with one share) are: W. B. and J. Bain, engineers, both of 52, Robertson Street, Glasgow. Secretary: A. McLean. Registered office: 52, Robertson Street, Glasgow.

Bernard Tomlinson, Ltd. (10,911).—Private company. Registered in Edinburgh January 21st. Capital, £3,000 in £1 shares. To acquire the business of a heating engineer formerly carried on by the late B. R. Tomlinson in Glasgow. The subscribers (each with one share) are: Mrs. A. Tomlinson, 969, Argyle Street, Glasgow; and J. E. Polding, 54, Hyde Street, Townhead, Glasgow, heating engineer and manager. The directors are: Mrs. A. Tomlinson, J. E. Polding and P. Daly, jun., 3a, Great Hamilton Street, Glasgow. Solicitors: Donaldson & Turnbull, 97, Willington Street, Glasgow.

Staffordshire Electrical Accessories Co., Ltd. (163,356).—Private company. Registered January 27th. Capital, £6,000 in £1 shares. To take over that portion of the business belonging to H. F. Howells and A. Douglas which relates to the repairing and overhauling of dynamos, motors and all kinds of electrical apparatus, electrical wiring, buying of motors and dynamos for sale, and sale of electric light accessories, carried on at 21a, Lichfield Street, Hanley, Staffs. The first directors are: H. F. Howells, 40, Lichfield Street, Hanley; A. Douglas, Norrisdene, Imperial Road, Matlock, Derbyshire. Solicitor: R. W. Beswick, 4, Bagnall Street, Hanley. Registered office: 21a, Lichfield Street, Hanley.

Brolt, Ltd. (163,372).—Registered January 28th. Capital, £350,000 in £1 shares. Objects: To take over the business of electrical and mechanical engineers, and manufacturers of and dealers in electrical apparatus, plant, fittings and apparatus of all kinds, carried on by Brolt, Ltd. (incorporated in 1911), at Birmingham and elsewhere. Minimum cash subscription 7 shares. The first directors are: B. Brooks, Blackwell Court, near Bromsgrove, Worcs.; A. C. Johnson, Napur, Wylde Green, Birmingham; A. Brown, Nayling Hurst, 138, Stamford Hill, N.; E. Brown, 2, Chesterfield Gardens, Hampstead, N.W.; H. W. Alexander, 83, Bunbury Road, Northfield, Birmingham. Solicitor: R. Pinsent, 6, Bennetts Hill, Birmingham.

Small Power Dynamo and Motor Co., Ltd. (163,409).—Private company. Registered January 28th. Capital, £5,000 in £1 shares. Objects: To take over the business of electrical and mechanical engineers, carried on by A. Radcliffe and F. S. Blakey at 129, Old Lane, Higher Openshaw, Manchester, as the "Small Power Dynamo and Motor Co." The subscribers (each with one share) are: A. Radcliffe, 18, Ackeroyd Avenue, Gorton, Manchester, electrical engineer; F. S. Blakey, Rosslyn, Grangethorpe Drive, Levenshulme, Manchester, electrical engineer. Permanent directors: A. Radcliffe and F. S. Blakey. Qualification, £100. Registered office: 129, Old Lane, Higher Openshaw, Manchester.

British East Africa Power Development Co., Ltd. (163,345).—Private company. Registered January 27th. Capital, £1,000 in £10 shares. The company is formed as a subsidiary company to the British Water Power Development Co., Ltd., to acquire, and if necessary extend (1) the Thika Sisal Hydro Electric plant; and (2) the head works and rights of Messrs. Swift, Rutherford & Co. on the Maragua River, both in Fort Hall District, British East Africa; to acquire all present and future rights, contracts, licences and concessions for the supply of hydro-electric power in British East Africa; to promote the development of hydro-electric, electric, hydraulic and water power (primarily in East and Central Africa), &c. The first directors are: D. Spencer, 1, Hall Place Gardens, St. Albans, director, British Water Power Development Co., Ltd.; R. B. Mackenzie, 5, Gordon Road, Ealing, W., director, British Water Power Development Co., Ltd.; W. F. Harwar, 10, Dulta Road, New Wandsworth, S.W., secretary, British Water Power Development Co., Ltd., and secretary, Tripline Investment Corporation, Ltd. Solicitor: L. M. Parkin, 114a, Chancery Lane, W.C. Registered office: 41, Parliament Street, S.W.1.

Power-Rectifiers, Ltd. (163,400).—Private company. Registered January 28th. Capital, £20,000 in £1 shares. To carry on the business of electrical and mechanical engineers, manufacturers of and dealers in transformers, mercury-arc rectifiers and accessories appertaining thereto, &c. The first directors are: G. Boner, Baden, Switzerland, manufacturer; A. C. Eborall (managing director), 9, Old Queen Street, Westminster, S.W., electrical engineer. Solicitor: W. T. Holland, 65, Bishopsgate, E.C.

Petter Gauge and Precision Tool Co., Ltd. (163,458).—Private company. Registered January 29th. Capital, £100 in £1 shares. To carry on the business indicated by the title. The subscribers (each with one share) are: V. G. Medley, 23, Austin Friars, E.C., chartered secretary; J. E. Batey, Greencroft, Old Farm Road, Sidcup, engineering works manager. Table "A" mainly applies. Secretary: V. G. H. Medley. Registered office: 23, Austin Friars, E.C.

Paxton's (Cardiff), Ltd. (163,221).—Private company. Registered January 23rd. Capital, £3,000 in £1 shares (1,000 founders). To take over, as from February 1st, 1919, the business of electrical engineers carried on by A. Paxton and H. W. C. Hinchley at Regal Works, Whitchurch Road, Cardiff. The first directors are: A. Paxton, 82, Westbourne Road, Penarth, engineer; H. W. C. Hinchley, 348, Whitchurch Road, Cardiff. Solicitor: A. Giles, 34, Queen Street, Cardiff.

National Electric Signs, Ltd. (163,301).—Private company.—Registered January 26th. Capital, £5,000 in £1 shares. To carry on the business of electric and illuminated sign manufacturers as formerly carried on by H. H. Scott and G. I. Scott at 57-59, Long Acre, W.C., as the "National Electric Sign Co." The subscribers (each with one share) are: W. J. Hosea-Ward, 20, Aylestone Avenue, Broadesbury, N.W.6, manufacturer of electrical goods; H. H. Scott, 59, Long Acre, W.C., electric sign manufacturer. The subscribers are to appoint the first directors. Registered office: 61 and 62, Lincoln's Inn Fields, W.C.

T. C. Smith, Ltd. (10,917).—Private company. Registered in Edinburgh January 23rd. Capital, £50,000 in £1 shares. To acquire from J. Duncan Nos. 21-25, Bon-accord Street, Aberdeen, the business carried on by him there as a motor and electrical engineer, &c., under the name of "T. C. Smith & Co." The subscribers (each with one share) are: J. Duncan, Tillycorthie, Odny, Aberdeenshire, mine owner; E. Milne, 21, Bon-accord Street, Aberdeen, manager; R. Watt, Bon-accord Street, Aberdeen, banker. The first directors are: J. Duncan, E. Milne and R. Watt. Registered office: 21, Bon-accord Street, Aberdeen.

Cowlishaw, Walker & Co. (1920), Ltd. (163,075).—Registered January 21st. Capital, £150,000 in £1 shares. To take over the business carried on at Etruria, Staffs, by Cowlishaw, Walker & Co., Ltd., and to carry on the business of manufacturers of and dealers in engines, boilers, colliery plant, brick and tile machinery, builders' plant, pumps, hoists, cranes, electrical appliances, &c. The directors are: E. W. Haig, Gatehampton House, Goring-on-Thames, director of Industrials, Ltd.; F. W. Poynor, 10, Gerrard Road, Barnes, S.W., director of Robert Warner & Co. (Engineers), Ltd.; W. A. Hunter, Charlton Lodge, Thornton Heath, managing director of Industrials, Ltd.; J. A. Edmondson, Woodville, Trentham Road, Stoke-on-Trent, joint managing director of Cowlishaw, Walker & Co., Ltd. Solicitors: Slaughter and May. Registered office: 14-16, Cockspur Street, S.W.

British Generator Co., Ltd. (163,515).—Private company. Registered January 30th. Capital, £5,000 in £1 shares. To take over the business of an electrical and mechanical engineer carried on by W. A. Hymas at 481, Oxford Road, Reading, as "W. A. Hymas & Co.," together with the rights of the said vendor in an invention for an electric lighting apparatus. The first directors are: W. A. Hymas, 481, Oxford Road, Reading; J. S. Mills, Woodview, Newton Abbot, Devon. Solicitor: F. J. Radcliffe, 1, Blagrove Street, Reading. Registered office: 481, Oxford Road, Reading.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Reform Lighting Co., Ltd.—Satisfaction registered December 19th, 1919, of £900, balance of charge for £2,750, registered March, 1913.

Browning & Lambert, Ltd.—Mortgage on Manor House stables, Folkestone, registered December 17th, 1919, to secure all moneys due or to become due from the company to L.J.C. & Midland Bank, Ltd.

English Electric Co., Ltd.—Mortgage on the company's undertaking and property, present and future, including uncalled capital, registered December 16th, 1919, to secure all moneys due or to become due from company to Lloyd's Bank, Ltd., not exceeding £500,000.

Cutting Bros., Ltd.—Particulars filed December 12th, 1919, of £20,000 2nd debentures, charged on the company's undertaking and property, present and future, including uncalled capital, amount of present issue being £12,000.

CITY NOTES.

Anglo-Argentine Tramways Co., Ltd.—In reply to many inquiries, the directors announce that the Municipality of Buenos Ayres, recognising the justice of the claim to an increase of fare to meet charges which were never contemplated when the concession rate was fixed, have sanctioned a conditional increase from 10 cents (the fare fixed by the company's concession) to 12 cents. It is hoped that the increase, which is to come into operation 90 days after promulgation of the ordinance, will place the company in a position, in the near future, to meet the pressing demands of Labour for increased wages, the cost of the reduction of the working day to eight hours, and its obligations under the new Pension Law, besides contributing materially towards the extra cost of working for which the abnormal price of fuel is largely responsible. The increased fare cannot affect the accounts for the year 1919 (which have had to bear the burden of heavy fuel charges), but will be in force during the major portion of the current year. The directors hope the alteration will enable them to resume, at an early date, payment of dividends on the first preference shares, which, since July 1st, 1917, have been passed.—*Times.*

Stock Exchange Notice.—Application has been made to the committee to allow the following to be officially quoted:—

Melbourne Electric Supply Co., Ltd.—£12,674 consolidated ordinary stock.

Llandudno & Colwyn Bay Electric Railway, Ltd.—For the year ended November, 1919, the profit was £5,196 (plus £387 brought forward), after providing for debenture charges. £1,860 is put to sinking fund, a dividend of 4 per cent. per annum (less tax) requires £2,783, and £940 is to be carried forward. There have been heavy increases in operating charges, owing to additions to pay and in maintenance charges, owing to exceptional expenditure upon repairs to and renewals of rolling stock and permanent way. The existing rolling stock is now in sound condition, and a small addition to the number of cars is now under consideration. The sinking fund instalment due on January 1st has been charged against the revenue for the year, and no further provision has been made for depreciation of the system.

Capital Increases in Germany.—The directors of the Bergmann Electricity Works Co. ask for authority to issue debentures up to 20,000,000 marks in case of necessity. The Duisburg Cable Works Co. propose to raise the share capital from 3,000,000 to 6,000,000 marks by the emission of new ordinary shares, each having triple voting powers. The share capital of Max Schorch & Co., of Rheydt, is to be increased from 2,625,000 to 10,500,000 marks; and an augmentation from 6,000,000 to 12,000,000 marks is to be carried out by the Dr. Paul Meyer Co., of Berlin.

Western Telegraph Co., Ltd.—The directors have decided to pay in March a dividend of 2½ per cent., and in the subsequent quarter a similar dividend, the intention being to pay a final dividend of 3½ per cent., making 10 per cent., free of tax, for the year, paying no bonus. 100,000 ordinary shares are to be issued to meet expenditure which is being incurred to add to and improve the cable services. They will be offered at par to shareholders.

Eastern Telegraph Co., Ltd.—The directors have decided to pay in May a final dividend for 1919 of 5½ per cent., making 10 per cent. for the year, free of tax, paying no bonus. £1,000,000 ordinary stock is to be issued to meet expenditure which is being incurred to add to and improve the cable services. It will be offered at par to holders of the ordinary stock.

Eastern Extension Australasia and China Telegraph Co., Ltd.—The directors have decided to pay in May next a final dividend for 1919 of 5½ per cent., making 10 per cent. for the year, free of tax, paying no bonus. 100,000 shares are to be issued to meet expenditure which is being incurred to add to and improve the cable services; they will be offered at par to shareholders.

City of Buenos Ayres Tramways (1904) Co., Ltd.—Balance dividend 1s. 3d. per share, making 5 per cent. per annum, less tax. To general amortisation fund, £6,200; carried forward, £138.

Mann, Egerton & Co., Ltd.—For the year ended September, 1919 (that is prior to the issue of the recent prospectus), dividend of 40 per cent. on 30,000 ordinary shares, carrying forward, subject to excess profits duty, £48,684.

Westminster Electric Supply Corporation, Ltd.—Dividend for the half-year ended December, 1919, at the rate of 13 per cent. per annum, less tax, making 10 per cent. for the year.

Calcutta Electric Supply Corporation, Ltd.—Units sold to consumers during four weeks ended December 26th, 1919, 2,224,603, compared with 2,000,352 in 1918.

STOCKS AND SHARES.

Tuesday Evening.

The difficulty this week is to know where to begin. Through all the ten decades—as they seem—that this hand has weekly (*sic*) written under the above heading, no one week can be recalled in which there have occurred such dramatic rises in cable stocks and electricity supply shares simultaneously. Eastern Telegraph went up 50 points last Thursday. City of London Electric ordinary has gained a pound per share in two days. And there are other rises to match. However cramp-ridden the hand, the thrill of such sensations reaches it. There is a genuine glow of satisfaction at being able to chronicle price-movements that must bring so much pleasure to the real investor; nor is the satisfaction lessened by the fact that it is purely sympathetic, and (unhappily), impersonal.

All of which, the Able Editor may parenthetically and chillingly remark, is distinctly out-of-place in an ordinarily staid, slightly dull feature of this paper.

Eastern Telegraph ordinary touched 220, a rise of 50 points, in a day. Eastern Extensions at 22 were 5½ up, Westerns at 23 showed a gain of the same amount, and Globe ordinary at 21 were about 5 better. The market, indeed, went off its head. Certainly there had been no expectation of the dividends going up to 10 per cent. on Easterns, Chinas and Westerns. Such a thing was not so much as intelligently forecast in these columns. But, of itself, the increase in the dividends would not have had an effect like this. It is the announcement of the new stock and shares to be offered at par which provides the cause of the excited rises. This is melon-cutting to some purpose, and if it be due in any way to a desire to get ahead of Budget possibilities, the cable companies' proprietors may feel that there yet remains balm in Gilead.

The full extent of the rises has not been held, as references to our tables show, but the net result of the week's work is startling enough to leave a feeling of the gratitude which is a lively sense of further favours to come, in the minds of those who await the substantial premiums which will be established, as a matter of course, upon the new issues after the preliminaries are over and the allotments make their appearance.

And should any investor, who has perhaps been moved to put money into these securities upon the strength of suggestions frequently made here, ask whether the present profit should be taken, the reply is that it would be difficult indeed to replace the stocks with anything equally sound.

Great Northern Telegraphs are £3 up, and Telegraph Constructions gained another 10s. at 27½. Henleys are 3-16 higher at 2 9-16 and Callender's ⅛ at 9¾, all of which advances are due to the strength of the Eastern market. Anglo-American deferred is 1½ better. United River Plate Telephones have recovered 2s. 6d. Automatic Telephones, after a dip to 30s., rallied to 34s. 6d. The report is due next month. Some of those who know—and Stock Exchange experience counsels especial caution in such a case—speak of a probably poor, or at best colourless, report, after which it may be right to "take your seats for the rise" if the price goes back at all. Last year the dividend was 6 per cent., the 1s. 2½d. being paid in March.

The all-round advance which has occurred throughout the list of electricity supply shares is due in the first place to the increased dividend declared by the Westminster company, which has led to expectations of similar improvements in the cases of the other companies. City of London ordinary has risen a pound this week to 14, because of the expectation of a bonus, so that those who bought the shares when this idea was first mooted in these columns three or four weeks ago have now a substantial profit. Nearly all the ordinary shares in the group are higher. With the outlook changed for the better, it is not surprising that holders decline to sell, the result being that there is little supply of stock available, and consequently prices are quick to respond to any demand.

The manufacturing list is generally good. As already noted, Callender's and Henley's have followed the rises amongst cable issues. Metropolitan-Vickers preference jumped 5s. to 3 1-16. Electric Constructions are better at 25s. No particular change has occurred in General Electrics. The air continues thick with gossip about amalgamations and new issues, and is rendered exhilarating by various denials. So prompt are the latter as a rule that it would appear to be simply asking for contradiction if the possibility were suggested of the General Electric Co., for instance, making a new issue next month of ordinary shares at 27s. 6d. per share, to be offered to shareholders in the proportion, shall we say, of one new share for every three at present held. The engineering group is also hard, Babcock's improving to 3¼.

Bombay Electric Trams have further soared to 112, and the preference at 15¾ are £1 up. Some people think that there is more than a fight for control going on. The Mexican list is heavy, and British Columbias have given way after their big rises. Brazilian Tractions recovered a point. Anglo-Argentines are a little easier. Rubber shares are somewhat colourless. Amongst armaments, Vickers & Armstrong display firmness. The Home Railway market is irregular, with Undergrounds flat on the uncertainty that envelopes the future of the Tubes.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Feb. 3, 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	8	6	+ ¼	£6 18 4
Charing Cross Ordinary	4	4	3⅞	+ ⅛	5 18 6
do. do. do 4½ Pref.	4½	4½	2⅞	—	8 8 8
Chelsea	5	5	3⅝	+ ¼	4 12 4
City of London	8	8	14	+1	5 14 4
do. do. 6 per cent. Pref.	6	6	9⅜	+ ⅛	6 4 8
County of London	7	7	9⅜	+ ⅛	7 5 5
do do. 6 per cent. Pref.	6	6	9	+ ¼	6 13 4
Kensington Ordinary	7	6	5	+ ¼	6 0 0
London Electric	Nil	Nil	1⅜	—	
do. do. 6 per cent. Pref.	5	6	8½	+ ¼	8 11 6
Metropolitan	4	5	3⅞	+ ¼	6 18 4
do. 4½ per cent. Pref.	4½	4½	2⅝	—	7 16 6
St. James' and Pall Mall	9	10	6⅜	+ ⅜	7 17 0
South London	5	5	2⅜	—	7 12 8
South Metropolitan Pref.	7	7	1	—	7 0 0
Westminster Ordinary	9	8	6	+ ¼	7 10 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	91½	+1½	6 11 2
do. Def.	1½	88/6	21½	—	7 1 2
Chile Telephone	8	8	8½	—	6 5 6
Cuba Sub. Ord.	7	7	10½	—	*6 18 4
Eastern Extension	8	8	20½	+4½	*4 17 7
Eastern Tel. Ord.	8	8	200	+34½	*5 0 0
Globe Tel. and T. Ord.	7	8	20	+3½	*4 18 6
do. do. Pref.	6	6	9½	—	6 6 4
Great Northern Tel.	22	22	26½	+3	8 6 0
Indo-European	18	18	48½	—	6 13 4
Marconi	20	25	4⅞	— 1/8	6 3 6
Oriental Telephone Ord.	15	10	2½xd	—	4 16 0
United R. Plate Tel.	8	8	8½	+ ¼	*4 18 6
West India and Panama	1/8	1/8	1⅛	— 1/8	5 9 6
Western Telegraph	8	8	20½	+ 3	*4 17 7
Home Rails.					
Central London Ord. Assented	4	4	58½	—	6 16 9
Metropolitan	1	1½	23	—1½	5 8 8
do. District	Nil	Nil	20½	— ¼	Nil
Underground Electric Ordinary	Nil	Nil	9⅞	— ⅛	Nil
do. do. "A"	Nil	Nil	5/8	—2/-	Nil
do. do. Income	4	5	81	—2½	*6 3 5
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	87	—	7 14 10
Anglo-Arg. Trams. First Pref.	5½	Nil	3⅝	— ¼	—
do. do. 2nd Pref.	—	—	3⅛	—	—
do. do. 5 Deb.	5	5	65½	—	7 12 8
Brazil Tractions	—	—	57	+1	—
Bombay Electric Pref.	6	6	15½	+1½	8 18 8
British Columbia Elec. Ry. Pfce.	5	5	64	—	7 15 0
do. do. Preferrred	Nil	2½	57½	—2	8 13 10
do. do. Deferred	Nil	Nil	52½	—3	5 14 3
do. do. Deb.	4½	4½	64	—	6 15
Mexico Trams 5 per cent. Bonds	Nil	Nil	46	—	Nil
do. 6 per cent. Bonds	Nil	Nil	35½	—	Nil
Mexican Light Common	Nil	Nil	22½	—	Nil
do. Pref.	Nil	Nil	35	—	Nil
do. 1st Bonds	Nil	Nil	52½	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3¼	+ ¼	*4 5 9
British Aluminium Ord.	10	10	1⅞	—	5 14 3
British Insulated Ord.	25	12½	2⅞	—	5 14 2
Callenders	25	25	9⅞	+ ¼	6 8 2
,, 6½ Pref.	5	6½	4⅞	—	7 2 1
Castner Kellner	25	20	4	—	—
Crompton Ord.	7	10	21/6	—	9 6 0
Edison-Swan, "A"	—	10	1⅝	— ⅛	7 12 4
do. do. 5 per cent. Deb.	4	5	79½	—	6 5 9
Electric Construction	10	10	1½	+ ⅛	8 0 0
Gen. Elec. Pref.	6	6½	19/6	+6d.	6 13 4
do. Ord.	10	10	41/-	—	*4 15 3
Henley	25	25	2⅞	+ ⅛	5 14 2
do. 4½ Pref.	4½	4½	3⅝	—	6 4 2
India-Rubber	10	10	16	—	*6 5 0
Met.-Vickers Pref.	—	—	3 1/16	+ ⅛	4 17 10
Siemens Ord.	—	10	28/-	—1/6	*7 2 10
Telegraph Con.	20	20	27½	+ ½	*4 3 8

* Dividends paid free of Income Tax.

WIRELESS DIRECTION FINDING.

By Capt. H. J. ROUND.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The major portion of this paper is confined to a sketch of the war developments of wireless direction and position finding, the general ideas involved in which are fairly well known now.

Early in September, 1914, possible uses of direction finding began to be evident to us, and we decided to try to improve the Bellini-Tosi arrangement. At Broomfield, standard Bellini-Tosi radiogoniometers were connected up to the receiving gear which was arranged to use either crystal only or valve plus crystal. When using the valve, reaction effects did not appear to cause serious trouble. Other troubles, however, were apparent. Owing to the short distance over which it was possible to receive signals on a frame when using only a crystal as a detector, only the very strong signals could be received. When starting work with the valve plus crystal, I found great divergence between the observed and true directions. Directions were taken when using crystals only, and also with valve plus crystal. In each case the observed directions agreed, which pointed to the fact that the errors were probably not due to the valve. Finally, nearly all errors were put down to two causes:—(1) A coupling between the two aerial systems not due to the search coil. This gave maximum errors in the plane of either aerial. (2) Incorrect tuning and consequent mis-phasing of the two aerial systems. This gave maximum errors in the plane of 45 deg. between the two aerials.

The first difficulty was overcome by setting out the aerial systems accurately and by more accurate manufacture of the radiogoniometers. The second, by abolishing the double condenser, which pretended to tune the two aerials simultaneously, and using two separate condensers. Tuning and phasing was done by means of a small buzzer-transmitting radiogoniometer coupled to the aerial systems.

The correction of the first error, until quite recently, always gave us trouble, particularly with short waves, owing to the electric coupling between the two aerials. The methods of checking that this coupling was zero were rather troublesome. Another series of errors appeared afterwards, due to badly constructed aerial-tuning condensers, and to very puzzling dielectric losses. The condensers first used had ebonite as the dielectric, and any small difference in the internal losses was swamped by the large internal loss. Other dielectric losses, such as those in walls and tables, were not noticeable until later when the aerials were made larger with respect to the wave length, and the potentials at the ends of the aerials consequently became higher. The introduction later of condensers having air as the dielectric gave trouble, owing to the type used being a built-up aluminium-vane condenser. It was found practically impossible to avoid resistance in the condenser, as contact to the aluminium vanes could never be made perfectly good. We therefore reverted to brass vanes solidly soldered up, and after this all trouble vanished from a condenser resistance point of view.

Multi-turn frames were seldom of any use in Bellini-Tosi work; a condenser could always be inserted to tune up one-rotating-frame work, is not required. Multi-turns, even if used in parallel to reduce inductance, have the disadvantage turn frames and direct connection with the aerials, as in that the inductance varies in windy weather. Single-turn frames chiefly used were:—

Wave length.	Shape.	Height.	Diameter.
200-400 metres	Diamond	50 ft.	50 ft.
400-800 „	(1) Square	60 „	60 „
	(2) Diamond	90 „	90 „
800 upwards	(1) Square	120 „	120 „
	(2) Diamond	170 „	170 „

Any larger sizes than these became difficult to handle, owing to the self-capacity of the frame becoming large compared with that of the tuning condenser. Actually, with modern amplifiers these frames give all that can be required in the way of signals.

During the war we made practically no alterations in the dimensions of the radiogoniometer coils designed by Bellini, except in the number of turns on the windings. Many were the schemes evolved both for tuning to the enemy wavelength and for taking his direction rapidly, say, all in the space of a few seconds. The difficulty was enormously increased by the extreme care with which the aerials had to be balanced. We found that if the aerials were tuned to, say, 800 metres and carefully balanced or phased, then by retuning the intermediate and final circuits, but without altering the aerial tuning, signals could be received with only a slight falling off in strength, from 200 metres below to 200 metres above this tune. This was due to the tight coupling of the radiogoniometer. If the final jigger coils were made of sufficient length, they worked over a big range without a condenser in parallel with them. With only the reaction coil and intermediate condenser to handle, operators became very expert at searching over considerable ranges of wave-length.

Aside from the above-mentioned errors, other errors were not at first serious. I had modified Franklin's reaction circuits for spark reception to give simpler tuning arrangements, and these circuits, when added to the Bellini-Tosi system corrected as above, made a very good direction finder. It was probably fortunate in the first year of our work that we used the soft valves, because no hard valve has been constructed which can compare with these "C" type valves as high-frequency magnifiers. They necessitated, however, trained men in their manufacture, and trained operators for their efficient use.

Fig. 1 shows characteristic curves of a "C" valve for comparison with that of a modern hard tube. The comparison will show that the "C" valve is equal in magnifying power either to 16 hard French valves in parallel, or to three in cascade. Actually, when used by a skilled operator, it is better than three in cascade in an amplifier having aperiodic intervalve connections. Some of the apparent amplification shown by the characteristic curves is actually not obtainable because, on account of grid conductivity, a large ratio of capacity to inductance is required in the grid tuning circuit. The use of this large ratio in the direction-finding receiving gear accidentally avoided for us the serious error known as "vertical," which was afterwards obtained with hard valves. With the "C" valve the average high-frequency magnification when using reaction was about 150. With high-frequency magnification the receiving power of the frame and Bellini-

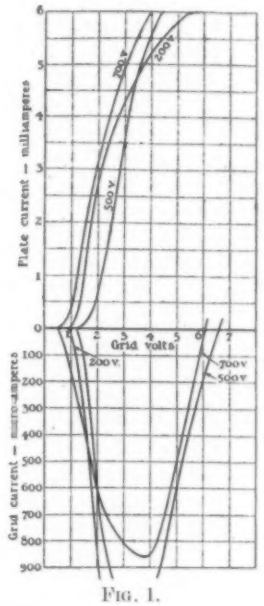


Fig. 1.

Tosi system at once became almost equal in value to that of the vertical aerial. In practice, it is possible to amplify up frame signals to a strength even greater than those of a vertical aerial, for owing to the frame's localised receptive diagram there is liable to be less interference. Fig 2 gives a diagram of one of the first circuits in use. Capt. Tremellen was very fond of the ingenious double-magnification circuit (fig. 3), due to Schlomilch, as was also the original high-frequency magnification without reaction. I usually preferred a single low-frequency amplification after the crystal.

The production of valves at that time was a terrible process. Again and again we lost the knack of making good ones, owing to some slight change in the materials used in their manufacture. A thorough investigation was impossible, as all hands were out on the stations. On several occasions we were down to our last dozen valves. This type of valve had been tested out on long waves at Clifden for quite long runs, and on those circuits it was very steady. The shorter waves necessitated higher values of filament current and lower values of vacua, thereby shortening the steady life considerably. It is, however, pleasant to record that "Methuselah" was removed after 8,500 hours, only to make room for a new circuit with hard valves, and this to the regret of the operators. Everything suggests that a long ageing is necessary to produce a steady valve, unless success is obtainable with a gas such as helium or neon. A spectrum analysis of

an old valve never showed anything but hydrogen, but with hydrogen I was never able to make a valve that was any good. A few valves were obtained which, after 1,000 hours, would run indefinitely as amplifiers or oscillators without any filament battery. The filament was apparently being heated by the H.T. battery, which was usually 400 volts.

Early in 1915 another error appeared which we nicknamed "Vertical." The two zeros of the polar diagram of reception were seldom opposite to another another. This was traced to a small "vertical aerial" receptive power, chiefly due to the difference in the capacity of the grid of the valve to earth, and of its battery to earth. I can probably explain the meaning of the error by taking the case of a frame directly connected to a valve (fig. 4), which, if not connected to the receiver, gets energy induced in it which gives a potential difference between the terminals A and D of the condenser. This potential difference is the correct cosine function of the direction. If now a valve grid G (fig. 4*a*) is connected to D, and the valve-filament battery B to A, the capacity of G is usually small compared with B, and, besides the true directional reception of the frame, there is a reception due to these

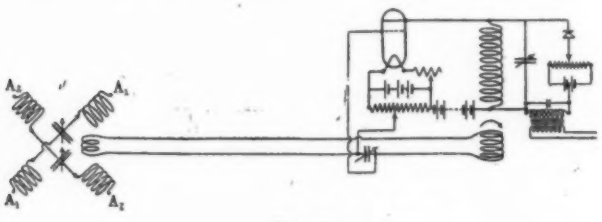


Fig. 2.

capacities to earth, I have redrawn this arrangement in fig. 4*b*, which shows the action of the wave in alternating-current form. Fig. 4*c* shows the arrangement in bridge form. Unless the capacity C is equal to the capacity H, a current will flow through the condenser AD, meaning that there is potential difference across the terminals A and D, which is independent of the directional properties of the frame. The result of this circular reception on top of the directional reception is a "cottage loaf" shaped diagram of reception, the minima of which are not opposite to one another.

With the use of hard valves, and the consequent high insulation of grids, these "vertical" troubles increased a great deal, and they increased still more when the "aperiodic" aerial was brought into use. Probably it has occurred to some that the extraordinary variation of signals at night might be accompanied by variations in apparent direction. In December, 1914, we erected in France, at Blendecques, near St. Omer, and at Abbeville, the first two war direction-finding stations, these making the first position-finding group erected by us during the war. Blendecques had a fixed daylight error which puzzled us, and not until Abbeville was constructed did Capt. Tremellen note that night directions did not maintain the constancy of day readings. The first station concerning which he noticed this effect was KAV, the old German press station, and fig. 5 is a copy of his original curve taken of KAV's movements during a sunset period. This curve is typical of a sunset movement, but I still cannot say whether

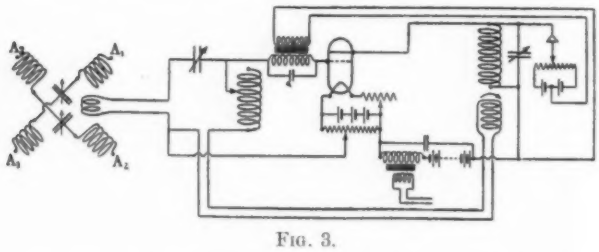


Fig. 3.

any such apparent regularity exists as a general thing, and certainly we were never able to arrive at any system of correcting bearings by using the idea of regularity. Night variation remained throughout the war a serious defect in direction-finding work. Capt. Tremellen and Lieut. Adcock in France among others, and particularly Lieut. Eckersley in Egypt and Salonica, succeeded in obtaining valuable information, the latter in conjunction with experiments developing the theoretical side. The work of these men suggests possible improvements in apparatus which will eliminate a great deal of the night trouble.

The German Navy directed its Zeppelin fleets by direction-finding from land stations. It also used a method of intercommunication between their land stations by wireless telegraphy. The Germans, in raids on England, suffered from a bad base-line, and this, in combination with night effects, made their directional apparatus useless on many occasions. The Germans had two wireless "light-houses" for enabling their Fleet and submarines to determine their positions in the North Sea without having to transmit. These wireless "light-houses" in effect consisted of a rotating frame continually sending during rotation. A signal was sent to give the zero of time, and any ship noting the time interval between this zero and the zero of signals could then determine its angular position from the station. The fact that a frame transmits vertically as well as horizontally, and that at different points in its rotation the vertical radiation is polarised in a different direction, should lead one to expect curious results at night. Owing to the continuous rotation of the transmitting frame, very strong signals were necessary to take quick bearings at a direction-finding station. Notwithstanding the difficulty, Capt. Tremellen was able to note a large variation of the apparent direction of these stations at night as the frame rotated. This was done by reading the minimum on his own radiogoniometer, and not by noting the minimum of signals with his search-coil stationary.

With regard to night effects, (1) Large swing readings are better than minimum readings. To obtain readings of the actual minima at night is very difficult. Fig. 6 represents a

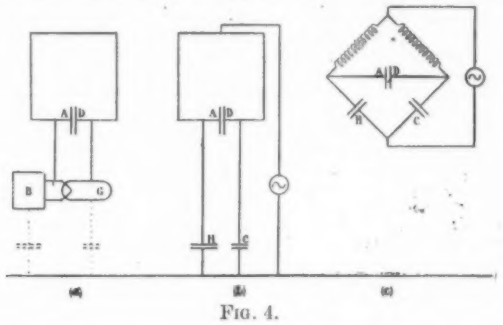


Fig. 4.

typical night minimum. This effect is sometimes very marked from Telefunken stations. Even with a swing reading, a very distinct difference of note will often be obtained at the positions A and B, the note on the one side having obviously fewer harmonics, *i.e.*, being duller in sound, than the note on the other side. This again adds to the difficulty, and the reason for the effect is not at all obvious. In England and France, errors on swing readings on spark stations are at present up to 7 deg. at night. Eckersley's results in the East indicate much greater changes than these; he has told me that at Salonica, Sofia would sometimes shift through 90 deg. The directions change fairly rapidly when bad night effects are present. Two or three degrees in a minute would, however, be considered to be fast. Nearly always, but not invariably, night variations are accompanied by bad minima.

(2) Continuous waves give much greater variations than spark waves, and with them it is quite definite that directions

Fig. 5.

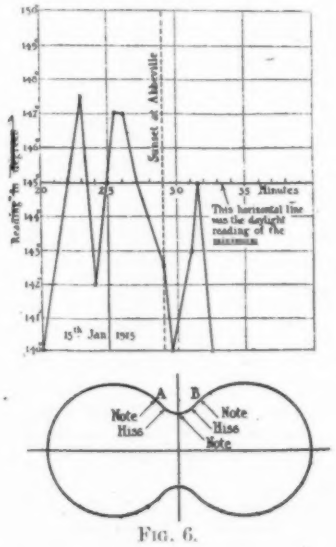


Fig. 6.

are seriously wrong even when the minima are extremely sharp, although bad minima do occur at other times. Capt. West brought to my attention a very pretty case of variation which indicates that the apparent direction is a function of the wave-length. Horsea arc station sent its Press programme at 10 o'clock nightly during parts of the war, and it sent with a spacing wave as well as a marking wave. These two waves sometimes gave two directions differing by 30 deg., each wave giving a perfectly sharp minimum. This point may be intimately connected with the results obtained at San Francisco by Dr. Lee de Forest some years ago on interference effects.

(3) There is no strong evidence to show that the night variations on long waves are greater than those on short.

(4) In England, variations from east to west are certainly greater than those from north to south, but I do not think that this result agrees with results from the East and from America. Malta was a peculiar station, which in England apparently never varied seriously.

(5) When signals come oversea from moderate distances, and practically no land intervenes, results are then the most reliable. If, however, there is land anywhere near either the transmitter or the receiver, or between the two, results become very troublesome.

The minimum distance at which night effects have been noticed in England or France is about 15 miles. Capt. Tremellen noticed quite early that when two transmitting stations with differently shaped aerials were side by side, the directions obtained at night by a Bellini-Tosi station were different. Mountainous country between stations seems to give the very worst night effects. Eckersley's theoretical and experimental work on night effects in the East, and with aeroplanes—also, quite independently, Adcock's work in France on aeroplanes—both suggested apparatus which should, when developed, improve our work at night.

(To be concluded.)

THE INSTITUTION OF ELECTRICAL ENGINEERS.

NORTH MIDLAND CENTRE.

The Chairman's address, of which the following is an abstract, was delivered before the above centre of the Institution by Mr. W. M. Selvey, M.I.E.E., at Leeds, on November 11th, 1919.

While many members have had the supreme privilege of serving at the Front, there have been many war-time activities of the members remaining at home. I wish to refer pointedly to the work of those local members which has resulted in that excellent report known as the "Report of the Yorkshire Electric Supply Linking-up Committee." This report, it is hoped, ultimately will be accessible to all members, and they will then see how carefully matters connected with Yorkshire have been considered. The phenomenal expansion of the Sheffield undertaking is almost a romance in itself.

We are also proud in referring to the first station on what is now known as super-station lines, viz., that at Rotherham, where is now being installed the largest set (30,000 kw.) yet built for this country. The Yorkshire Electric Power Co. has also made most effective progress, not only in largely extending its generating capacity, but also in wonderfully extending its system of overhead mains. There is no other system in this country which can show anything like such progress in this direction. The Leeds extensions are also somewhat noteworthy. Other large extensions have been projected, but war circumstances have delayed them in many cases. In Yorkshire in 1918 the generated units were over 520,000,000, with a maximum demand of over 160,000 kw. Personally, I expect that during the next ten years Yorkshire, with its woollen, steel, and coal industries, will become the most highly organised electrical area in any part of the world.

Another phase of activity in which the members of this centre have been largely employed is that of giving assistance to the Coal Controller. There were over 25 of the members of this centre who assisted in this voluntary work. Should the principle of nationalisation become more extended the electrical engineer of a district could, with a maximum advantage to the community, become responsible for the whole use of power in his district, either if such power is taken from the public mains, or is generated by a private plant whether by steam or gas. Such a scope would lead to balanced thought and a proper perspective with regard to the interests of the community. If the members had previously been only half convinced of the value of a generous electricity supply to the community they must have become wholly convinced by their experience in this work. The waste of fuel, the carelessness, indifference, and the ignorance of power users in many lines of industry were most disturbing. The training of the electrical engineer in power generation has been shown to be exceedingly helpful in dealing with all questions where the combustion of fuel is concerned, whether for power or other purposes.

The past year is especially notable with regard to influence on the future of the Institution arising from the efforts of our most able past-president, Mr. C. H. Wordingham, C.B.E. He has given us all a new idea of what the Institution may be and, may I say, shall be in the lives of all its members. We must all join in making our new president realise that he has the whole-hearted feeling of the members behind him.

After dealing with Institution affairs, Mr. Selvey gives a number of technical calculations relating to high-pressure and high-temperature steam with interheating for power generation, which are intended to be read as an appendix to Mr. J. H. Shaw's paper.* The author keeps very closely to the figures used by Mr. Shaw; he gives tables and figures defined by the nature of steam, and independent of any form of apparatus, which can be used in any particular case by taking into account the efficiency of the apparatus. The schedules are accompanied by temperature-entropy and interheat diagrams illustrating some of the tables.

Schedule 1 relates to diagram efficiencies obtainable with steam initially at 500 lb. per sq. in. absolute, total temperature 688 deg. F., where the steam after expanding and doing work to certain selected pressures is again heated to the original temperature and then further expanded down to vacuum pressures. The figures represent what could be obtained were it possible to build a heat engine of 100 per cent. mechanical efficiency, and if there were no losses of pressure in conveying the steam to be reheated from and to the engine. It will be easy to find the influence of such losses as are inevitable by means of curves drawn from the data given in this and the other schedules. The best circumstances for interheating are by expanding to a pressure in the neighbourhood of 200 lb. per sq. in. before reheating, and the possible gain in efficiency is of the order of 2½ per cent.

Schedule 2 takes the same circumstances with the difference that while expanding to the same set of pressures the steam is not reheated to its original temperature, but only to its original superheat. All practical cases must lie between these two limits. Under these circumstances the best pressure for a single interheat is above 200 lb., and the possible gain in efficiency is of the order of 1¼ per cent.

Schedule 3 shows that there is a fairly wide range of choice for two interheats for which the efficiency remains sensibly constant, the most favourable of these conditions being an expansion first to 215 lb., reheating, and then an expansion to 70 lb., and further reheating with a final expansion from 70 lb. to the vacuum pressure. These calculations show a possible gain in efficiency over plain expansion of about 1½ per cent.

Schedule 4 shows clearly that the value of interheating is greater in proportion as the initial pressure is lower. Expansion from 500 lb. with an interheat to the original temperature at 150 lb. shows a gain for plain expansion from 500 lb. of only 2.4 per cent. Steam originally at 150 lb. interheated at 50 lb. to the original temperature of 688 deg. F. shows a gain over plain expansion from 150 lb. of 7.2 per cent.

Schedule 5 shows the value of pressure alone for the constant top temperature. The absolute pressure of 215 lb., that is of 200 lb. gauge, is taken as a basis. The figures show that at 500 lb. the gain is 11 per cent., whereas at 70 lb. pressure there is a deficit of 15 per cent.

Schedule 6 gives the same set of figures, but with the superheat kept at the constant figure of 219.3 degrees F. It is seen that the gain of 500 lb. over 215 lb. is as much as 13 per cent.

Schedule 7 compares the main efficiencies with those obtainable with a perfect fluid between the same limits of temperature. The author then gives temperature-entropy and interheat diagrams which show more quickly what the variations of efficiency mean, and concludes that in the near future the steam turbine may equal, if not surpass, the gas engine in efficiency, the competition being still more severe in overall efficiency since the efficiency of large boilers in the most modern practice is now showing a margin of nearly 10 per cent. over the corresponding gas producer efficiency. The battle between these two methods of producing power may turn on the direct total utilisation of the rejected heat. It is along these lines one looks for progress rather than in much further improvement of the efficiency of these prime movers.

* Elec. Rev., July 19th, 1918.

An Ionisation Gauge.—The design of ionisation gauge used in the General Electric Co.'s laboratory consists, according to the *Journal* of the Franklin Institute, of two concentric tungsten filaments inside a coaxially situated cylinder. The inner filament is used as a source of electrons with the outer one as anode, while the cylinder is used as a positive ion collector. The gauge was calibrated by a "flow" method (based on Knudson's formula for the flow of gases through capillaries) for extremely low pressure, and it was found that the electron emission is proportional to the pressure over a range which extends from over 10 bars to 10^{-3} bars, and it is, therefore, probably certain that this same relation holds at the lowest attainable pressures. Calibration of the gauge with different gases led to the interesting relation that the number of positive ions formed at constant electron emission and constant pressure is proportional to the number of electrons per molecule of the gas ionised. It is possible, therefore, by this method to determine *molar numbers* for different gases, by which is meant the sum of the products, atomic number times number of atoms, taken for each element in the molecule. Thus the molar number of iodine is $2\times53=106$; and for HgI, it is $80+2\times53=186$. Vapour pressure determinations of both these substances gave results agreeing with the above values for the molar numbers. If it be assumed that ionisation is due to collisions between thermions and electrons in the atoms, it is possible to calculate the mean free path of an electron in any gas at a given pressure, and also the effective diameter of the electron. For argon at 1 bar pressure and room temperature, the mean free path is about 150 cm., and the diameter of the electron is calculated on this basis as about 4.4×10^{-9} cm.

ELECTRIC ARC WELDING.

During the recent extension of the use of electric arc welding very considerable progress has been made in the development of suitable plant and equipment to provide the desired electrical conditions at the arc. It is now realised that reliable and consistently sound welded joints cannot be secured except by the use of electrodes capable of depositing metal of similar quality to the work, thereby permitting true fusion and furnishing a jointure with maximum efficiency. That such conditions are obtained we were last week able to see for ourselves, when a most interesting and instructive afternoon was spent at the works of Alloy Welding Processes, Ltd., where "A.W.P." electrodes and other welding products were seen in course of manufacture, and an opportunity was given of appreciating the general use and extent of service to construction and repair work offered by this process. This firm has made a special study of the requirements, and alloy rods and electrodes, specially prepared to enable true fusion to be obtained in joining together all kinds of iron and steel parts, including special alloy steels, are now available for use with either the gas blow pipe or electric arc respectively. It is perhaps unnecessary to point out the scope offered by electric arc welding for the carrying out of repairs of all descriptions, and the repair work undertaken at the "A.W.P." works for, amongst others, the L.C.C. tramways, London General Omnibus Co., and the Midland Railway, is of extreme interest both from the point of view of the success attained and the nature of the repairs carried out.

During the war period it was established that the electric arc welding process was sound and adequate by virtue of the experience obtained in the assembling of mines, bombs, tanks, and other munitions, besides the construction of seagoing craft entirely built by this means. This fact was further demonstrated by this method of construction having been approved by the Admiralty and Lloyd's Register of Shipping after extensive investigations and trial. Further, the lengthy recommendations that accompany the annual report by Mr. G. Scott Ram, H.M. Electrical Inspector of Factories, indicate the importance attached to electric welding as a recognised manufacturing method with considerable future possibilities.

The flux-covered electrode was not in the past appreciated to the extent it deserved, mainly because the correct method of application was not understood, and insufficient attention was given to the selection and preparation of the welding material. As a result of the investigations carried out by Mr. E. H. Jones, very satisfactory results have been achieved. The "A.W.P." electrode, provided with an extruded flux coating of variable constituents, employed to weld mild-steel plates and cast iron, may be manipulated by an ordinary craftsman at greater speed than was previously considered possible, and in addition, the resultant welded joints possess maximum tensile strength, whilst the work easily withstands bending, impact, and fatigue strains. This achievement is due to the fact that with these electrodes metal deposited in the weld can be varied to suit the materials to be joined together, and provides a sound jointure without special skill being required on the part of the operator, which has hitherto been the main factor in successful welding practice. Moreover, with composite electrodes, the rare metals composing the alloy to be deposited are kept apart until actual fusion in the arc; this point is of first importance, as it is found that it is only possible by this means to deposit high-speed, nickel, manganese, and other special alloy steels which cannot be otherwise treated. By depositing metal slightly superior in quality to the parent metal, the latter is strengthened by absorbing some of the superiority of the deposited metal. In the past the parent metal adjacent to the weld was often weakened by the reverse action being allowed to take place.

A feature of "A.W.P." electrodes is that in all cases they are given a coating of nickel, which is claimed to give superior results in that it obviates oxidisation. This coating varies from 1 to 10 per cent., according to the composition of the electrode, the average being about 4 per cent. of the total weight of the electrode. A very successful method of electrolytically coating electrodes has been adopted at the company's works, and it is claimed that as much as 4 per cent. of the weight of the article being coated can be deposited per hour. The deposit is of a high quality, and will not crack on repeated bending.

As representing a portion of the work that can be satisfactorily dealt with by this means an entirely new application of the arc process has been opened up in the tool-making industry. The method of depositing a tip of high-speed cutting steel direct from an electrode on to mild-steel shanks has been improved and simplified, and its general adoption in the making and retipping of tools, drills, picks, &c., is only a matter of time. It is probable that in the shipbuilding and repairing industries arc welding will find its biggest individual application. English railway systems have recently begun to realise the value of such a process in their constructional and repair shops, while on tramway and light railway systems arc welding has already obtained a firm footing for the repair of rolling stock and general upkeep of permanent way. In steel tank and barrel manufacture, the process is especially applicable owing to its economy and property of watertightness, while in structural and reinforced concrete work, advantages equal to those realised in shipyards are found in its application.

The efficient repair of cast iron is a matter that looms large before every engineer, and it is impossible to treat it as anything but a separate application. An electrode is now manufactured which, it is claimed, actually produces molten cast iron of the first quality, and the repairs already carried out confirm its future.

The self-contained, portable, or semi-portable as desired, welding plant supplied by the "A.W.P." Co. consists in one case of a special Premier generator direct coupled to a 9-h.p. Gardner internal combustion engine complete with radiator, fan, fuel tank, &c., mounted on a girder bedplate, and all the necessary switchgear mounted on a slate panel as shown in fig. 1. In the other case it consists of a motor and generator direct coupled and mounted on a steel girder bedplate with the necessary switchboards for connection to a supply circuit.

For use on a.c. circuits transformer plant, as shown in fig. 2, has been developed; several of these sets were seen in operation at the time of our visit to the works, as were also adjustable reactance coils for connection to a.c. circuits of from 70 to 110 volts, the current at the arc being varied by altering the plug and socket connections. Where a 60 to 110-volt d.c. supply is available it is only necessary to connect up an adjustable resistance for each operator.

An exhaustive series of tests was recently carried out for Lloyd's Register of Shipping, who have since certified approval of "A.W.P." electrodes for use in ship repair and construction as outlined in Lloyd's Regulations for the application of electric arc welding to ship construction. These welds were made with alternating current with transformer welding plant of the standard type shown in fig. 2. In the tensile tests the welds were neither hammered nor swaged during or after welding, and the average result of the twelve tensile pieces tested reached the high figure of 27.3 tons per sq. in.

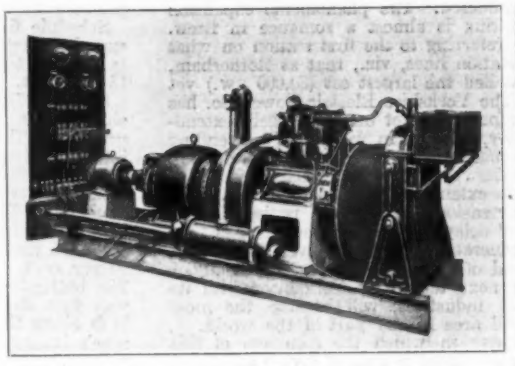


Fig. 1.—Self-contained A.W.P. Welding Plant.

Fig. 2.—a.c. Welding Transformer.

In eight cases out of ten the original plate broke without the weld giving way, and the actual strength of the weld the weld metal withstood an average stress of 28.8 tons per was shown better in the modulus of elasticity tests, where sq. in. before fracturing. A feature of the tensile tests was the high elongation shown in the welded samples; the final extension in 8 in. on eight welded pieces was 18.4 per cent., which compares favourably with 25 to 30 per cent. for mild steel.

Modulus of elasticity tests were carried out on test bars composed entirely of deposited electrode metal. The average result of 12,000 tons per sq. in. can be compared with wrought iron at 12,500 and mild steel at 13,500. The ultimate breaking stress of 29 tons per sq. in. and the elongation of 13 per cent. in 8 in. should be noted. Impact tests showed the ability of welds to withstand severe shock without sign of failure.

Alternating stress tests determined that an unwelded turned steel bar would withstand a large number of alternations (5,000,000 and over) when the stress varied from + 10½ tons per sq. in. to − 10½ tons per sq. in.

The importance of chemical analysis of welds is sometimes overlooked by users of electrodes. The analysis showed that the deposited metal from an "A.W.P." electrode contained .106 per cent. carbon and .48 per cent. manganese, both approximately correct for the formation of mild steel, while the

embrittling and harmful elements of silicon, phosphorus, and sulphur were kept well below dangerous proportions, and in the case of silicon and phosphorus (both elements which lower the tenacity of steel) very considerably reduced when compared with the original plates. These figures refer to standard electrodes and not to special alloy electrodes, with which practically any desired chemical composition can, it is claimed, be obtained. The series of micrographs made in conjunction with these tests were sufficient to show the good fusion between weld and plate and absence of heat effect upon the plate adjacent to the weld. Two series of these tests were carried out, namely, with A.C. 50 cycles at 80 volts, and with D.C. at 60 volts.

In addition to the above, tensile and bending tests were carried out at the National Physical Laboratory, Teddington, with A.C. 50 cycles, 80 volts, on test pieces prepared according to the British Engineering Standards Association, and welded by the electric arc process with old type and "A.W.P." standard electrodes. Finally, trials have been carried out by the Admiralty at Portsmouth dockyard with D.C. at 60 volts, reversed polarity being employed throughout for all positions of work. The trials were carried out by a dockyard operator with no previous special skill in the manipulation of the firm's electrodes.

In conclusion, we have to thank Mr. J. Caldwell, Mr. H. B. Sayers, and Mr. E. H. Jones for the courteous manner in which we were received at the time of our visit.

CHANGING LIVE LINE INSULATORS.

Sudden insulator failures on a 25-mile, 22,000-volt, overhead transmission line five years old caused a central station in northern Pennsylvania, U.S.A., to adopt a novel method of dealing with the trouble. The line runs through hilly country which is noted for its frequent and violent lightning storms. Steps had to be taken to avert serious trouble without interrupting the service. According to the *Electrical World*, instead of waiting for insulator failures to manifest themselves, a picked line gang was instructed in detecting bad insulators on a live line and in changing them. The men travelled from one end of the line to the other, stopping at each pole. If a buzzing sound was heard the insulator was defective and changed. Before climbing any pole, to be assured of safety it was tested with a telephone receiver to determine the amount of leakage current to earth, and the potential drop was measured every 6 ft. At night the men camped in a tent wherever they happened to be, and regular inspection was thereby assured. Changing insulators was accomplished by means of Cronin tools mounted on poles, as shown in fig. 1. Tool A is used for tying the conductor to the insulator when the latter is equipped with a tie wire made of two pieces of wire, the same size as the line conductor, and attached to the pin insulator before it is mounted on the cross arm. The tie wire E is seen arranged on the insulator so that it will not be a menace, and also F in position to be tied to the conductor. The two hooks on the tying wrench A make

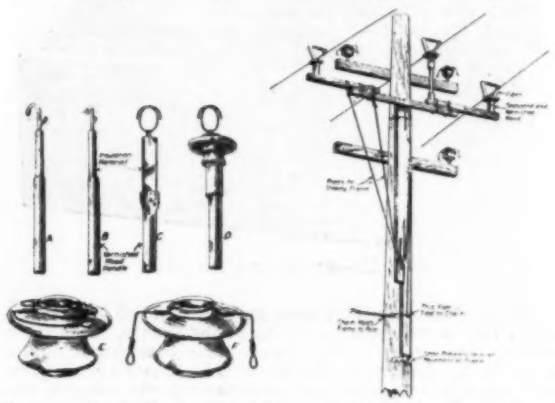


Fig. 1.—Tools Employed in Changing Live Line Insulators.

it easy to tie the conductor firmly to the insulator in a few minutes. When an ordinary tie wire is employed the untying wrench B is used. The tie wire can be gripped in the claw of this tool no matter how tightly it is clinched. After the conductor is set free it can be lifted from the insulator by means of tool C, and held away while the latter is changed. When an insulator is defective and new ones are not available, the cleaning tool D can be fastened to the conductor and clamped to the pole; it consists of an insulator mounted on a pole, and is used as an insulator in an emergency. When cross arms need replacing, or when it is desired to change all the insulators at the same time, the "strong man" shown on the right-hand side of fig. 1 is used. The use of this frame allows the raising of the wires above the top of the pole by means of a rope and pulley. On handling the insulators the tie wires are bent as shown at E to avoid accidental contact with the live conductors. After the insulator is placed on the cross arm the tie wire is bent down ready for tying, as shown at F. Two men work on the pole at once, and one remains on the ground. The process can be accomplished with ease in less than half an hour, and when used to the work the men show no fatigue.

THE PHYSICAL SOCIETY'S EXHIBITION.

(*Concluded from page* 138.)

Messrs. H. Tinsley & Co. had a large and varied collection of apparatus on view. Their thermo-electric potentiometer (the manufacture of which was undertaken specially for the National Physical Laboratory) is the first of its kind made in England. It consists essentially of a divided circuit, the potential being obtained from two points in each arm of the circuit. Fig. 16 shows the theoretical diagram. The potentiometer current is kept at a standard value in the usual manner by equating the drop across a resistance to a standard cell. The current entering at the point A divides the resistance of the two branches, being so arranged that the current in the right-hand arm is 1/10 that in the left. This proportion is always maintained for any position of the switches by means of the compensating coils which are put in circuit as others are cut out. The top and bottom sets of coils are interconnected so that the top contact moves to the right while the bottom moves to the left. Similarly, the same total resistance is maintained, when either the right or left-hand decades are moved, as will be seen from fig. 16.

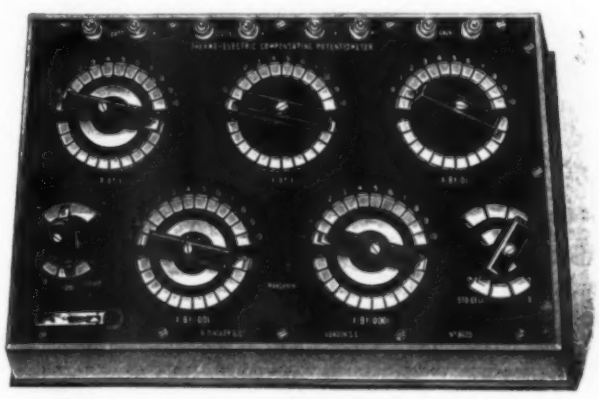


Fig. 15.—Thermo-electric Compensating Potentiometer.

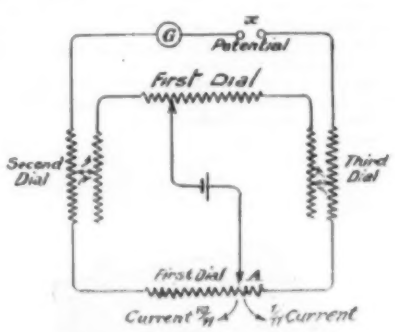


Fig. 16.—Diagram of Connections.

Any thermo E.M.F. which may occur due to the motion of the switch is rendered negligible by this arrangement of divided circuit. If an E.M.F. occurs upon the moving of the switch on the first dial, the thermo E.M.F. will become added to the battery E.M.F. of about 2 v., and is therefore negligible. If the thermo E.M.F. occurs on moving the switch of the second or third dial, it will act in a divided circuit, one side of which will be added to, while the other is subtracted from the main E.M.F., the resultant alteration being negligible, never exceeding 1.3 per cent. of the value of the thermo E.M.F., which would not itself exceed one microvolt. Moving the switches when the instrument is set up gives no deflection of the galvanometer such as usually occurs.

A double Kelvin bridge was shown specially constructed to provide a self-contained instrument for low-resistance mea-

surements. Four standard resistances are contained in the instrument, 1 ohm, 0.1 ohm, and 0.001 ohm. By use of the ratios, measurements can be made to five figures of all values of resistance from 1,000 ohms to 0.001 ohm. Terminals are provided for measuring against independent standards if required.

Another feature of the exhibit was Gall & Tinsley's artificial track-circuit, specially designed for research upon the problems of the track circuit. It brings into the laboratory a two-mile section of line in every condition of construction, maintenance, and weather, and where, moreover, the extremities are within a few inches of each other, allowing the same instruments to be used for measurement at and between opposite ends, and the behaviour of apparatus at each end to be observed simultaneously. It is made suitable for either A.C. or D.C. circuits, the former type serving for both, but the latter of a more simple form and suited only for D.C. The research type is provided with four dials which may be set to represent any condition of ballast resistance and rail impedance between 1 and 100 ohms of the former and 0 and 2 ohms resistance or 0 and 2 ohms reactance of the latter. The dials give the values of rail resistance in ohms, the rail reactance in ohms at some fixed frequency, and the value of the ballast resistance in ohms. The instrument is designed for a normal current at the relay end of 5 amperes, and the reactances are adjusted at this figure. As is the case with the track circuit itself, the reactance of the rails varies with the current, and a correction for various values of current is given with each instrument. The instrument represents the electrical conditions obtaining in any section of the line, having a rail impedance as given by the setting of the dials, between which is a ballast of the resistance given by the dial so named. The convenience of this piece of apparatus for the testing of track—transformers, relays, regulating resistances, &c., under actual conditions—will be appreciated by all who have attempted to carry out such tests upon the permanent way itself, where the conditions are not under control, and have first to be determined before the values of rail-impedance and ballast resistance are known, and further where only one condition of these can be had at once, or worse, a condition so continuously changing over a small range as often to destroy the value of the tests made. On the site tests usually have to be made at night to avoid continual interruption by traffic, and in the worst weather, to get the most unfavourable conditions. Tests of the track-circuit constants can also be made with great facility by using the artificial track circuit in balance against the actual track-circuit and adjusting the dials until the artificial electrically balances the real track-circuit.

The standardisation of low-resistance shunts has been made a speciality by the company. Two sizes of the Drysdale-Tinsley non-inductive type were shown, together with their temperature-resistance curves.

A new pattern of potentiometer that was shown has been developed to give the same range as Tinsley's universal potentiometer, but without using a slide wire. This instrument is provided with three dials, the first reading (when using a 2-volt accumulator) .1 volt per stud, the second .001 volt per stud, and the third .0001 volt per stud. The second dial is the "Vernier" dial, it being shunted across any two studs of the first dial according to the position of that index. A ratio plug allows the potentiometer to be used to read up to 18 volts or down to one microvolt.

Another item was a new variable self and mutual inductor, with a range from 6 to 159 millihenries self-inductance and 0 to 34 millihenries mutual inductance.

Mr. H. W. SULLIVAN had an interesting exhibit of non-reactive resistance boxes, slide wires, &c., standard air-condensers, both fixed and adjustable, galvanometers of laboratory and marine types, and wireless telegraph apparatus.

FIG. 17.—SULLIVAN UNIVERSAL AIR CONDENSER.

Fig. 17 shows an air condenser containing three units, two fixed and one continuously variable, with switches for paralleling them, and a rotating head, giving a range from 0 to 1,000 micro-mfd. continuously, with very fine adjustment. Another condenser is fitted with a specially long scale, extending to 320 deg.

A thermionic valve oscillator for generating high-frequency currents is illustrated in fig. 18; it contains everything except a condenser by means of which the pitch of the note can be adjusted, and the 200-volt battery and filament battery. This set is specially suitable for A.C. bridge testing, as steady frequencies from 300 to several thousand cycles per second can be obtained, with an approximately pure sine wave. A three-valve amplifying receiver was shown in conjunction with the Edison Swan Electric Co., Ltd., in operation. This set, which is illustrated in fig. 19, is suitable for spark

FIG. 18.—THERMIONIC VALVE OSCILLATOR.

FIG. 19.—AMPLIFYING RECEIVER.

reception, over a range of wave lengths from 200 to 4,000 m., which can be extended by means of inductance. This set is self-contained, only the telephones and batteries being external to it. The valves act as radio-frequency amplifiers as well as detectors, and are reactance-capacity coupled, this being superior to the resistance-capacity method of coupling, particularly on the shorter wave-lengths.

The WESTINGHOUSE COOPER HEWITT CO., LTD., showed a quartz mercury vapour medical lamp for the production of ultra-violet rays, mounted in a spherical housing of burnished aluminium which was specially designed to facilitate the use of the lamp, and to maintain the necessary conditions of operation. Other apparatus was exhibited, for examining X-ray photographs, rifle barrels, &c.

Mr. W. H. HARLING and Messrs. HENRY HUGHES & SON, LTD., showed drawing instruments of new types, generally following the lines of the Continental instruments of pre-war days. The British instruments were unexcelled in quality, but were not suitable for machine production; the new designs, which were got out to meet the needs of the Ministry of Munitions during the war, while retaining many of the high-class features of the British in-

struments, are of standardised pattern suitable for manufacture with accurate repetition machinery, and can be turned out in great quantities, while they have the advantage that each part is easily replaceable. The machine production of these instruments is a new industry in this country, which if adequately supported will be captured from the Germans.

Messrs. Marconi's Wireless Telegraph Co., Ltd., had an interesting exhibit of measuring instruments—including a new form of hot-wire instrument specially suitable for the measurement of high-frequency currents—a compact direction-finder of the marine pattern, Fleming and Round valves, and an amplifying detector suitable for the reception of continuous-wave or spark signals, with a range of wave-length from 500 to 3,000 m., and for use in connection with the operation of recording devices. The hot-wire ammeter was provided with a method of zero adjustment which did not affect the calibration, and was fitted with a transformer in which the secondary was independent of the primary aerial circuit, so that an injury to the instrument had no effect on the aerial circuit.

NEW ELECTRIC LOCOMOTIVES.

The recent extension of an additional 217 miles on the Chicago, Milwaukee, and St. Paul Railway, that is now electrified from Seattle on East, makes an interesting addition to the electrification of this noteworthy railroad. For the past two years 440 miles of this railway have been electrified over the Rocky Mountain passes, thus the new addition makes available over 650 miles, and by next spring it is estimated that over 800 miles in all will be in operation. According to the *General Electric Review*, as a result of its unqualified success, the same system will now be used to meet the severe grades and snow conditions of the Cascade range. The motive power consists of 42 locomotives for freight and passenger service and four switchers. Of this original equipment,* the freight and passenger locomotives differed only in the gear ratios. The five new locomotives being constructed by the General Electric Co. for operating the heavy main-line transcontinental passenger trains on the section Seattle-Tacoma-Othello are entirely different in design, built distinctively for passenger service, and possess some very interesting mechanical and electrical features. The section is 200 miles long, and includes a stretch of 17 miles of 2.2 per cent. grade and another, 19 miles long, of 1.7 per cent.; it is worked at 3,000 volts D.C., and regenerative braking is employed.

Designed to haul, unassisted, 12-coach passenger trains weighing 960 tons against a 2 per cent. grade at 25 M.P.H., the new locomotives are of the gearless type, with bi-polar motors, the motor armatures being mounted directly on the driving axles. Each locomotive weighs 265 tons, 229 tons being on the drivers. Of the 14 axles, twelve are driving and two are guiding. The weight of the armature and wheels is the only deadweight on the track, and this is approximately 9,500 lb. per axle. The total weight on drivers (458,000 lb.) is 86 per cent. of the weight of the locomotive, and is distributed 38,166 lb. on each axle. The total length inside

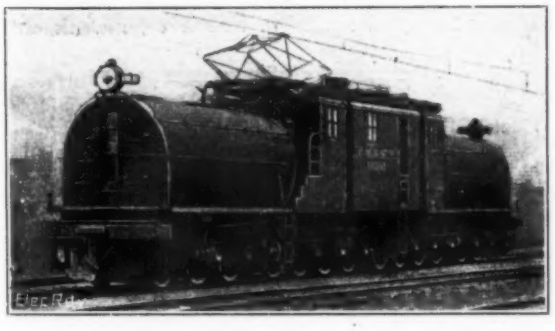


Fig. 1.—A New G.E.C. 3,240-h.p. Electric Passenger Locomotive.

knuckles is 76 ft., and the length over cab, 68 ft. The driving wheels are 44 in. in diameter; the leading and trailing wheels 36 in. in diameter; the total wheel-base is 67 ft. Curved-top cabs at each end of the locomotive contain the 3,000-volt contactors and grid resisters. In one of these cabs there is also located a 3,000-volt D.C. air-compressor and storage battery; in the other a small motor-generator set (for operating the contactors and for train lighting) and the high-speed circuit breaker. Two operating cabs are provided, and situated between them is a cab occupied by an oil-fired steam boiler and accessories for heating passenger trains. A sliding pantograph is mounted on top of each of the two operating cabs. These pantographs have two sliding contacts, giving a total of four points per slider with the double trolley. The second pantograph is held in reserve as a spare.

* Elec. Rev., June 21st, July 12th and 19th, 1918.

Speeds of 65 M.P.H. were attained during the tests of one of these locomotives, fig. 1, on the G.E.C. testing track at Erie. The tests have been described as "the most magnificent exhibition of electricity applied to railroads ever seen." A feature was a tug of war between the electric and two powerful modern steam engines as used on the New York Central Railway for hauling the big limited trains. The three locomotives were securely coupled together, and the danger of pulling out the draw bars was avoided by making them push against each other in different directions. The steam engines got under way and pushed the electric ahead of them along a straight track; then energy was gradually switched on to the electric while the throttles of the steam engines were opened fully. To the surprise of the spectators the steam engines were seen to slowly but surely lose momentum, and finally come to a complete stop, still with their throttles wide open. Next they were forced backwards, and as the electric developed its full power the procession became almost a rout.

Hardly second in interest to the above performance, was the exhibition of the regenerative powers of the electric locomotive. To reproduce the same conditions as those which exist when the engine is coasting with a full load of cars behind it, two steam locomotives were coupled on behind the electric and pushed it along the track at a good speed. The regenerative system was then put in action, and the speed was seen to noticeably decrease, and before the trial ended the two steam engines had as much as they could do to make headway under full steam. At times during this test instruments showed that as much as 2,000 KW. was being returned by the locomotive through the sub-station.

KARL VON SIEMENS ON THE SITUATION.

A very despondent view of the situation in Germany is entertained by Herr Karl F. von Siemens, chairman of the Siemens & Halske Co., Berlin. Addressing the shareholders at the recent annual meeting, he is reported to have stated that the path upon which German economic life is moving is leading to conditions which are becoming worse and worse and more difficult. The turnover of industry in money is in course of constant increase, not owing to greater production, but to the depreciation of the currency. For the present, and as a consequence of the great German famine in goods as well as that of the whole world, it is possible for many industries to cover the increased working expenses, notwithstanding the reduced output. It is, however, noticeable in many branches that there is a limit beyond which it is impossible to think of satisfying the demand, because the working expenses cannot be recouped; and in the case of many transport undertakings, it has already been shown that increases in the fares do not produce any additional receipts on account of the reduction in the traffic. Similarly, manufactures are possibly available, but the consumers who have to pay the purchase prices are too few, and the output must, therefore, undergo a further decline, as the costs of production are still growing. The course of the economic machine should not be allowed to proceed without regulation, but it should be entrusted to the care of experienced men.

The chairman, proceeding to discuss the economic life of the country, stated that it is too frequently asserted that this is dependent upon other countries, and that the Germans will soon come into swing again if they can again obtain the necessary raw materials from abroad. In his opinion this argument may be correct in regard to one or two industries, but it is not the case with many of them, and in these instances the decline is just as great as in those which need foreign materials. The principal thing lacking is coal, not because the Germans have lost too much coal, or have to make deliveries to their late enemies, but because an insufficient quantity of coal is produced as compared with former peace times, and cannot be distributed among consumers. Under these circumstances the recovery of industry in the first place is a question of coal, and iron, and steel, and the Siemens and Halske Co. suffers the most from these causes. A lack of foreign raw materials does not exist for the time being, but there is a great scarcity of semi-finished German and foreign materials. There is very little the company can do to co-operate in remedying the evil as the company belongs to the manufacturing industry which can do nothing with purely raw materials, but must receive them from other industries in a semi-finished condition.

Coming to consider the labour question, the chairman remarked that as contrasted with former periods, the many strikes at present imply a complete loss of the production, as it is impossible to recover the lost output owing to the veto on the working of overtime, and the indisposition to work efficiently. The introduction of politics in the labour relationship has not only brought about a reduction in the efficiency of the workmen and employers, but the capacity of the managers and leading officials has also fallen to a minimum, as their time is constantly occupied with negotiations within and without the works, so that there is no possibility of their activity being concentrated on their particular departments. The sudden introduction of wages agreements which have required years for development in other industries, and which exhibit many defects owing to the shortness of the time and the lack of experience, has put many workmen out of tune and considerably prejudiced the desire to work on the part of those aspiring elements upon whom alone progress rests. The reputation of the German engineering industry, said Herr von Siemens, is based upon the quality of its work, which stands unequalled; and besides the intellectual work, it has been built up chiefly by the superiority of

the German special workmen. If, however, aptitude and ability no longer find their due reward, every incentive is undermined, and the quality of the work suffers, and Germany will therewith lose an important factor for her reconstruction. The speaker then referred to the coming into operation of the Works Councils Law, which, it is feared, will be used by the dominating radical element for the purpose of producing further disturbance in industry.

Herr von Siemens, in conclusion, confirmed the report that the company has associated itself with the A.E.G. and the Osram works in the amalgamation of the glow-lamp works, believing that this branch will be strengthened by joining the combination. It is hoped by means of an interchange of experience and the systematic division of the production to improve the quality of the lamps and reduce the costs of manufacturing, in order to facilitate the trade contest with foreign competitors.

NEW PATENTS APPLIED FOR 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

1,612. "Electric fire." H. J. DEAN-OSGOOD. January 19th.

1,627. "Circuits of ignition systems of internal-combustion engines." M. S. CONNER and C. C. PUCKETTE. January 19th.

1,645. "Electrically-heated apparatus." R. K. HEARN. January 19th.

1,650. "Eletrically-operated pumps." MERRYWEATHER & SONS and J. H. OSBORNE. January 19th.

1,659. "Electric devices." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). January 19th.

1,668. "Magnetic controlled pendulum." W. A. PACKER. January 19th.

1,670. "Commutators." A. B. BUCKLEY. January 19th.

1,686. "Magnets of rotating wheel type for sparking coils of internal-combustion engines." BOSCH. AKT. GES. R. January 19th. (Germany, November 21st, 1918.)

1,687. "Ignition apparatus for internal-combustion engines." BOSCH AKT. GES. R. January 19th. (Germany, March 15th, 1919.)

1,714. "Magnetos." J. H. TOURNAYRE. January 19th. (France, June 28th, 1919.)

1,750. "Electric welding, brazing and soldering machines, &c." W. J. READETT. January 20th.

1,763. "Protective arrangements for electric distribution systems." A. REYROLLE & Co. (J. C. van Staveren). January 20th.

1,768. "Electrically-propelled vehicle." J. H. HANSEN. January 20th.

1,810. "Rotary electric transforming apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). January 20th.

1,821. "Electric switches." L. MOSER. January 20th. (France, April 19th, 1919.)

1,830. "Sparking plugs." R. F. HALL. January 20th.

1,840. "Electric induction furnaces." COMPAGNIE FRANCAISE DES METAUX. January 20th. (France, February 7th, 1919.)

1,843. "Battery ignition for internal-combustion engines." BOSCH AKT. GES. R. January 20th. (Germany, November 25th, 1918.)

1,844. "Electric lighting of automobiles." BOSCH AKT. GES. R. January 20th.

1,871. "Wireless telegraphy and telephony." W. H. ECCLES and J. H. VINCENT. January 21st.

1,872. "Device for testing sparking plugs." J. B. TUCKER. January 21st.

1,873. "Electric switches." J. B. TUCKER. January 21st.

1,880. "Electric heater and disinfector for beds." H. C. MEYER. January 21st.

1,887. "Electric burglar alarm." T. FRASER. January 21st.

1,893. "Electric hand lamps." H. J. DALLISAL. January 21st.

1,913. "Sparking plugs." J. E. BARROWS. January 21st.

1,959. "Electricity motor meters." J. HARRIS. January 21st.

1,966. "Electric switches." L. MOSER. January 21st.

1,973. "Controllers for electric railways operated by high-voltage direct current." AKT. GES. BROWN, BOVERI ET CIE. January 21st. (Switzerland, January 21st, 1919.)

1,978. "Projector for glow-lamps." BOSCH AKT. GES. R. January 21st. (Germany, May 11th, 1919.)

1,981. "Electrolytic production of magnesium from anhydrous magnesium chloride." E. A. ASHCROFT. January 21st.

1,982. "Spark plugs." J. O. BROCK. January 21st. (United States, March 9th, 1916.)

2,005. "Wireless telegraphy receivers." H. P. REES. January 21st.

2,024. "Sparking plugs." G. H. BARRACLOUGH. January 22nd.

2,029. "Mouthpieces for telephone transmitters." G. A. LINES. January 22nd.

2,031. "Apparatus for grinding electric commutators or distributors." F. BOLTON. January 22nd.

2,054. "Electro-magnetic wave signalling." J. HOLLINGWORTH. January 22nd.

2,061. "Spark plugs." F. HACHMANN. January 22nd.

2,069. "Transformers." G. LIGNORI. January 22nd.

2,084. "Electro-magnetic switches." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). January 22nd.

2,118. "Regulating devices for thermostats." J. E. GEE. January 22nd.

2,130. "Clips for holding tubular electrical conduits." J. DOGGETT. January 23rd.

2,133. "Automatic telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO. and J. SAVIN. January 23rd.

2,151. "Electrical machinery." S. TWEEDALE. January 23rd.

2,175. "Ignition of internal-combustion engines." THOMAS TRANSMISSION, LTD., and K. J. THOMSON. January 23rd.

2,186. "Dynamo-electric machines." W. PARKER and SIEMENS BROS. DYNAMO WORKS. January 23rd.

2,204. "Antiseptic telephone mouthpiece." D. LUZENBURG. January 23rd.

2,236. "Electrical resistances, potentiometers, &c." E. W. KITCHIN. January 24th.

2,237. "Transmitters for electrical signalling systems." W. H. CHATTER. January 24th.

2,302. "Automatic switches for dynamos." H. LUCAS and H. N. URQUHART. January 24th.

2,303. "Electrodes for electric arc welding." BRITISH ARC WELDING CO. and H. OGDEN. January 24th.

2,304. "Electrical transference of designs in textile arts." E. C. R. MARKS (Oesterreichische Siemens-Schuckart Werke and Regal-Patente Ges.). January 24th.

2,327. "Apparatus for electric heating of hot-bulb engines." G. B. PETTER and PETTERS, LTD. January 24th.

2,338. "Electric valves or tubes for wireless telegraphy and telephony." H. M. AIREY, G. B. BRYAN, C. L. FORTESCUE, and A. K. MACRORIE. January 23rd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.

8,529. APPARATUS FOR THE ELECTRICAL SEPARATION OF SUBSTANCES IN SUSPENSION IN GASEOUS MEDIA. Soc. Gallot et Cie. and Soc. Poussin, Rondeaux et Cie. May 22nd, 1917. (116,104.)

10,454. ELECTRODES FOR ELECTRO-OSMOTIC PROCESSES. Elektro-Osmose Akt. Ges. (Graf Schwerin Ges.) October 20th, 1917. (135,816.)

21,458. DYNAMO-ELECTRIC MACHINES. E. J. Harman and E. Le Bas. December 21st, 1918. (137,089.)

21,466. MEASUREMENT OF ALTERNATING ELECTRIC CURRENT POWER. S. Z. de Ferranti, G. Wall, and Ferranti, Ltd. December 21st, 1918. (Cognate application 15,447/19.) (137,090.)

21,667. WIRELESS TELEPHONE TRANSMITTERS. L. B. Turner and R. H. Wagner. December 24th, 1918. (137,098.)

21,698. GENERATION OF ELECTRICITY BY THERMO-ELECTRIC BATTERIES. C. M. Walter. December 30th, 1918. (137,101.)

1919.

140. INTERRUPTORS FOR USE IN ELECTRIC IGNITION SYSTEMS. Dayton Engineering Laboratories Co. January 2nd, 1918. (122,185.)

1,986. SUSPENDING CONDUCTOR WIRES ON ELECTRIC RAILWAYS AND THE LIKE. F. W. Fawdry and P. Dawson. January 27th, 1919. (137,133.)

2,320. CONTROL OF THE IGNITION OF INTERNAL-COMBUSTION ENGINES. Humber, Ltd., and J. A. Cole. February 6th, 1919. (137,142.)

3,137. STARTING AND SYNCHRONISING OF SYNCHRONOUS DYNAMO-ELECTRIC MACHINES. R. E. Grime and Mather & Platt. February 8th, 1919. (137,144.)

3,476. ELECTRO-MAGNETIC RELAYS. British L.M. Ericsson Manufacturing Co., N. Blades and A. E. Sutherland. February 13th, 1919. (137,147.)

3,692. ELECTRO-MAGNETIC STEP-BY-STEP SIGNALLING AND SYNCHRONOUS ROTATION. C. L. Walker. February 14th, 1919. (137,150.)

4,101. METHOD OF LOCKING ELECTRIC LAMPS IN THEIR HOLDERS FOR USE WITH MAJOLICA FITTINGS AND THE LIKE. J. H. Collie. February 19th, 1919. (137,155.)

5,955. SPARKING PLUGS. L. S. Clarke. March 11th, 1919. (137,177.)

7,287. IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. F. C. M. Cesbron. March 22nd, 1918. (124,750.)

8,360. TWO, THREE, OR MULTIPLE PIN PLUGS. Naamlooze Vennootschap Fabriek van Instrumenten en Electrische Apparaten "Inventum." April 4th, 1918. (125,077.)

8,759. WINDING OF INDUCTION COILS. F. Weatherall. April 7th, 1919. (137,199.)

12,319. ELECTRICAL MEASURING INSTRUMENTS. A. W. Lishman. May 16th, 1919. (137,223.)

15,054. SECRET-CONTACT COMBINATION ELECTRIC SWITCHES. E. W. Walsh and C. H. G. Kingsland. June 16th, 1919. (137,237.)

15,758. ELECTRIC COOKING OR HEATING VESSELS AND APPARATUS. C. H. Lauth. December 23rd, 1918. (Divided application on 21,547/18.) (137,240.)

15,759. ELECTRIC COOKING OR HEATING VESSELS. C. A. Lauth. December 23rd, 1918. (Divided application on 21,547/18.) (137,241.)

18,133. ELECTRIC LAUNDRY IRONS. A. E. Fitzgerald. July 21st, 1919. (137,249.)

19,418. SPARK-PLUGS. A. H. Cressy. August 6th, 1919. (137,254.)

19,699. ELECTRO-MAGNETIC STEP-BY-STEP AND LIKE MECHANISM. C. L. Walker. February 14th, 1919. (Divided application on 3,692/19.) (137,255.)

20,580. REMOTE CONTROL ELECTRIC SWITCH. P. Perot. August 21st, 1919. (137,261.)

26,746. ELECTRIC SPARKING PLUGS. Etablissements de Dion-Bouton, Soc. Anon. December 12th, 1918. (136,801.)

30,207. THERMIC TELEPHONE SYSTEMS. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. December 4th, 1918. (136,162.)

Electric Fire Engines.—In different parts of the world, notably Germany and the U.S.A., electrically-propelled fire engines have been used to a considerable extent, while in London the L.C.C. Fire Brigade employs a total of 15 such vehicles, states Mr. F. Ayton, chairman of the Electric Vehicle Committee of Great Britain. A repeat order for two turntable ladders mounted on Tilling-Stevens petrol-electric chassis which have been in use for some time in the L.C.C. Fire Brigade, has recently been received by the company. The ladder, which, when fully extended, measures 85 ft., is operated electrically, power being obtained by simply connecting the ladder motor to the chassis generator by means of a switch, the engine being kept running. The ladder can be used either as an escape or as a water tower. The Hanwell Council is considering the purchase of a Tilling-Stevens petrol-electric fire engine.

Ships' Lights.—The President of the Board of Trade has appointed a committee, under the chairmanship of Mr. Clifford C. Paterson, O.B.E., to consider whether, in order to secure that ships' lights shall comply with the requirements of the International Collision Regulations, it is desirable to lay down standards for the lights, or any parts of them; and, if so, to advise what those standards should be, and what is the best method of securing compliance with them. Mr. J. W. T. Walsh, of the National Physical Laboratory, and Mr. A. S. Hoskin, of the Board of Trade, will act as joint secretaries to the committee. Any communication with regard to the matters to be considered by the committee should be addressed to the secretary, Ships' Lights Committee, Board of Trade, Great George Street, S.W. 1.—*The Times.*